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BRUSSELS REUNION OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

The official convention of the International Electrotechnical Commission, expected to have been held in Berlin this year, has been deferred probably for a twelvemonth. The Belgian National Committee has, however, issued invitations to other national committees to attend a "réunion amicale," or a gathering of only semi-official status, at Brussels, during the week of Aug. 7 to 13. Two or three meetings have been scheduled during that week for the informal interchange of opinion among members of different national committees on subjects within the scope of the commission. The general idea seems to be that by the aid of this informal discussion a program of constructive action can be arrived at in advance of the Berlin convention much more effectively than by scattered correspondence. The remainder of the week may be taken up in visits to the Brussels Exposition and to neighboring factories or places of electrotechnical interest. It seems likely that a large gathering will be formed of representatives from the various national committees, of which there are now more than a dozen in existence. It is to be hoped that some definite plans may be developed at the Brussels reunion, if the commission is to justify its existence. It has already been in organization for four years, and in all of that time it has officially accomplished little more than the formulation of its own by-laws. Nevertheless, there is a large amount of important international work that it is capable of carrying out if its internal mechanism can be brought into effective operation.

THE SINGLE-PHASE COMMUTATOR GENERATOR.

Practically any type of motor possessing constant-speed, or so-called "shunt," characteristics, can be operated as a generator without any change other than that necessary to produce, or tend to produce, an increase in speed of the revolving member. That is to say, to the extent that the load on a motor tends to vary its speed, an external tendency to vary the speed alters the load; and a sufficient effort to increase the speed will reduce the load to zero and give it a negative or generator value. A machine which requires external excitation when operated as a motor will likewise require external excitation when used as a generator. A motor which requires no external excitation can be operated as a self-exciting generator without change in its constructional features and interconnections. When the secondary of an induction motor is provided with a commutator on the rotor and the exciting magnetomotive force is introduced by way of this commutator, the value of the volt-amperes for excitation is much less than that required for excitation by way of the primary circuit. By this means it is possible to decrease the exciting volt-amperes to any desired extent. In an article in this issue, Mr. Val A. Fynn describes fully the performance characteristics of an induction-type machine provided with a commutator for receiving external excitation when operated

as a generator. The machine differs from the familiar induction generator in several important features, the most prominent being the use of secondary current for excitation and the dependence of the generated frequency upon the introduced current rather than upon the speed of rotation.

ABSORPTION-OF-LIGHT METHOD OF CALCULATING ILLUMINATION.

The article by Dr. A. S. McAllister, printed elsewhere in this issue, contains some interesting theoretical considerations relating to illumination that deserve recognition from illuminating engineers, if only on account of the remarkable numerical results. The propositions laid down are unimpeachable under the limitations specified. The question of the practical application of these propositions is, however, necessarily complex, owing to the partial removal of these limitations. In considering the artificial lighting of any interior, say, a rectangular hallway, if we assume, for the sake of discussion, that walls, floor, and ceiling are all of the same light-reflecting power, so as to be all equally absorptive, and, moreover, that a certain average illumination is desired over all these surfaces, then following the reasoning in the article, it is incontrovertible that the total light required from the lamps in the room must be equal to the total light absorbed by the surfaces, which in its turn is equal to the total interior surface multiplied by the rate of absorption. Thus, if the total interior surface of the chamber is 1000 sq. ft., and the average incident illumination 1 ft.-candle, then the total incident illumination on the interior will be 1000 lumens. If the surface absorbed all of this light like black velvet, the lamps in the room would have to supply the entire flux of 1000 lumens; but if we assume that the surface everywhere absorbs only 40 per cent, or throws back 60 per cent, of the incident light, the total flux absorbed is 400 lumens. Consequently, the lamps will only have to emit 400 lumens in order to maintain the total incident flux of 1000, the balance being supplied by flux returned from the interior surface. It is to be noticed, as clearly pointed out in the article, that this proposition pays no attention to the uniformity of illumination on the interior surface. The illumination might be very nearly uniform, as supplied, say, by a large number of small scattered lamps; or it might be very un-uniform as supplied, say, by a single strong lamp in one corner of the hall. Provided that the average interior illumination was 1 ft.-candle, a 400-lumen lamp, that is, a lamp of 31.8 mean spherical candles, would meet the assumed conditions.

It is evident that the absorption method of attacking the assumed problem is a powerful one, because it shows in a very simple way that the lamps to be installed have to produce only 400 lumens instead of 1000, but the weak point of the application is in regard to the average incident illumination. From the standpoint of practical illumination, the average illuminations of the interior surfaces of any chamber are seldom a significant factor, or a criterion of the merit of the illumination. In all cases the designer of the illumination has three separate purposes in mind, namely, to meet the requirements (1) of discernment, (2) of scrutiny, and (3) of æsthetic appearance. That is, there must first always be enough light to go about by without colliding against obstacles; an illumination of a few hundredths of a foot-candle is usually ample for this purpose. Secondly, there must be adequate illumination for scrutinizing optical work on tables, or desks, where reading or the careful use of implements, needs to be carried on; say, 2 ft.-candles or more at these surfaces. Thirdly, the entire illumination in regard to colors, lights, shadows, and contrasts should be as pleasing as possible, with no sharp, bright intensities on the one hand, nor broad patches of dull uniformity on the other, within any normal field of vision. It is evident that these three collateral purposes, or trinity of purpose, do not call for any particular unity of average illumination on the interior surface as a whole, or any large portion thereof, such as floor, walls, or ceiling.

Good illumination is, indeed, as a general rule, varied illumination, with plenty of shadows, preferably emanating from but few dominant sources, and with intensities of illuminations skilfully arranged to be powerful where most needed, but economized where no scrutiny is required. Bright lights in the direct field of view are the unpardonable sin, unless high above the level of the observer's eye, and one candle per square inch of visible illuminant is a good rule for maximum visible intrinsic brightness. We do best in imitating sunlight, which gives us strong contrasts and shadows with few arid patches of uniform illumination. All of these avenues of purpose lead unconsciously to the direct computation of light sources by the radius-vector method, and deflect from the method of determining them by absorption. Nevertheless, Dr. McAllister's absorption doctrine is so strong a device for determining limits of luminous emission that it should be invoked by the engineer, whenever possible, as a check upon the radius-vector computations. It lies always in the background of every illuminating problem, like the doctrine of the conservation of energy in every physical problem. Indeed, the absorption doctrine forms a sectional part of the energy doctrine. That is, the illuminating engineer, after having assigned the required light sources in the interior under consideration, might do well to ascertain the respective areas of floor, walls and ceiling, attach an estimated absorptive power to each in accordance with the local conditions, roughly ascertain the average illumination on each, and compute the total absorption. If the total absorption in lumens equals the total emission in lumens as already estimated, the results may be considered to check.

ELECTRIC POWER TRANSMISSION IN SWEDEN.

A recent paper in a London contemporary, abstracted in the Digest, gives an instructive general view of what has been accomplished in electric power transmission in Sweden. The topographical characteristics of the Scandinavian peninsula are such as give it an exceptionally large amount of water-power. The great central mountain range, with abundant rainfall, is never distant from the sea even on the Swedish side, and water-powers are both plentiful and easily developed. This plentiful hydraulic power is compressed into a small space; for the whole area of Sweden is less than that of Montana, yet it has available water-power reckoned at 3,800,000 hp, of which more than 500,000 hp is now developed. Its density of population is about the same as that of the United States, yet Sweden has an available water-power amounting to more than 1 hp per inhabitant. It is difficult to imagine such lavishness of Nature in supplying power to an active and industrious country. How would the United States appreciate near 100,000,000 available hydroelectric horse-power?

Electric power transmission in Sweden started at about the same time as in the United States, and under the same impulse of the development of polyphase transmission, the first commercial plant being installed in 1893. This transmission was but little smaller than the first American plant and in each case it is curious to note that the original machinery is still in use. Since that time the growth has been rapid. It is especially noteworthy that several of the most important Swedish plants are primarily for electrochemical processes. The hydraulic plants have little to distinguish them from well-built plants in other countries except that as a rule the canals are comparatively short and the heads rather better than in this country. Storage in lakes is largely practiced owing to the exceptionally considerable lake area available. Between 8 per cent and 9 per cent of the total area of the kingdom is in lakes and many of these are of good elevation.

The general type of the electrical apparatus is closely similar to that used here. The machines are almost entirely three-phase at 50 cycles, although a few 25-cycle plants have been constructed, particularly where railway work was contemplated. The general practice in machine voltage and transformation is about the same as in America, except that it is worth noting that two 1500-kw generators, furnishing directly 20,000 volts, are in service. The distances of transmission are for the most part moderate, so that the extremely high voltages to which we are sometimes driven in this country are not employed, the longest distance yet covered being about 60 miles. It is interesting to find, however, a project for sending power clear to Copenhagen, a distance of a little over 200 miles, including a five-mile transmission across the outlet of the Baltic between Sweden and Denmark. Taken altogether power transmission in Sweden is certainly in a high state of development, which reflects great credit on the enterprising and engineering skill of our Scandinavian friends. Particularly again we would call attention to the importance of electrochemical work which gives an outlet for power in large quantities as a uniform load. With electrochemical works to fall back upon for the delivery of very large amounts of power over short transmissions, it is possible to keep the load factor of a hydraulic station at a point seldom reached in any other class of service.

THE TEMPERATURE VARIATION IN THE MAGNETIC PROPERTIES OF IRON UNDER FEEBLE MAGNETIZING FORCES.

The recent trend of magnetic research has been toward the effect of temperature on the magnetic properties of magnetic metals. It is coming to be recognized that magnetic quality is closely associated with the temperature of the substance, and with the recent history of changes in that temperature. In fact, a proper apprehension of the magnetic behavior in metals cannot be obtained without adequate consideration of its temperature relations. For example, ordinary iron ceases to be strongly magnetic when heated above the critical temperature, although it regains its magnetic properties after recooling. In a recent paper to the Académie des Sciences, by M. Ch. Maurain, some researches have been reported on the magnetic behavior of iron, at different temperatures, and under very feeble magnetizing forces. Two series of results are given—namely, the ordinary magnetization, and a special type of magnetization, called by the author "anhysteretic magnetization."

It is well known that when very powerful magnetizing forces are applied to iron, the resulting flux density is nearly the same whether the magnetic forces are increasing or diminishing. But when, on the contrary, the magnetizing force $\mathfrak{H}$ is small, the value of $\mathfrak{B}$ may differ very greatly, and sometimes enormously, according to whether $\mathfrak{H}$ is increasing or decreasing. Any large hysteretic loop displays this condition. M. Maurain has sought to eliminate the influence of molecular magnetic friction by applying magnetic oscillations superposed upon the magnetizing force. Along with the magnetizing force he has superposed at different times (1) an alternating magnetic field of diminishing strength; (2) a decreasing alternating current through the core; (3) a decreasing oscillatory magnetic field, and (4) a decreasing oscillatory current through the core. As might be expected, none of these results coincide, but they all approach what may be called the ideal anhysteretic magnetization curve—that is, the curve that would connect intensity of magnetization $\mathfrak{I}$ with magnetizing force $\mathfrak{H}$, if there were no molecular magnetic friction. Manifestly, the ideal anhysteretic magnetization curve would be the same whether the magnetizing force was being increased or decreased. According to the tests reported, a sample ring of iron very nearly pure—containing only 0.046 per cent of carbon, 0.012 per cent of manganese, and 0.006 per cent of silicon—was slowly raised in temperature from 16 deg. C. to 750 deg. C. During this heating process the magnetic intensity was measured for a feeble intensity of 0.091 gilbert per centimeter, or a weak earth's field, both anhysteretically, and in the ordinary way. The intensity, measured in the ordinary way, rose slowly from 16 unit poles per square centimeter to 166 at the highest temperature. That is, the increase of temperature from 16 deg. C. to 750 deg. C. increased the intensity from 10 to 166. Nearly all of the change took place, however, after passing 500 deg. C., because at 550 deg. C. the intensity was only 21.7 unit poles per square centimeter.

By the anhysteretic method, using an alternating magnetic field slowly diminished to zero, the magnetic intensity produced in the iron by the same magnetizing force ($\mathfrak{H}=0.091$ gilbert per centimeter) was nearly the same over the entire range of temperature, being $\mathfrak{I}=435$ unit poles per square centimeter at 16 deg. C., 396 at 550 deg. C. and 473 at 750 deg. C. The minimum was at 550 deg. C. Stating the presented facts in another way, the permeability of the iron, measured by the ordinary method, increased from 1380 at 16 deg. C. to 22,900 at 750 deg. C.; whereas, measured anhysteretically, the permeability varied only between the limits of 58,500 and 72,200. It would seem, therefore, that the anhysteretic method of measuring the flux density in iron for varying magnetizing forces would be useful for small ranges of the latter, so as to obtain nearly the same curve in ascending as in descending. The technique of the method is, of course, somewhat more complex than that of the ordinary method, because the alternating current has to pass through a separate solenoid, and its strength must be reduced from the proper upper limit to zero in the proper period of time. Moreover, unless the technique of this alternating magnetic field superposition can be standardized in some way, different observers are likely to obtain different results. Nevertheless, the possibility of securing in this manner a normal magnetization curve, the same for ascending as descending magnetizing forces, is very encouraging and well worth striving for.

The St. Louis Convention.

By Telegraph.

The St. Louis convention of the National Electric Light Association, the thirty-third in number and marking the twenty-fifth anniversary of the organization, began here yesterday (Monday) under most promising conditions, with the opening of exhibits of associated members. The special convention trains bearing delegates from the east, west and north arrived on time and without mishap. The electric light special from Chicago left at 10 a. m. Monday over the Chicago and Alton Railroad in charge of Mr. John J. Schayer, assistant master of transportation for the National Electric Light Association. Mr. R. J. McKay, general passenger agent of the road, was on board to see that every comfort was afforded the travelers. The train made the run in 6½ hours, arriving in St. Louis on schedule time. About seventy had reservations. The Commonwealth Edison Company and the North Shore Electric Company were, of course, the most largely represented. The train was made up of one observation, two parlor, one sleeper and two dining cars. The delegates expressed pleasure at the way the railroad company provided for the noonday meal with two dining cars and a liberal bill of fare. A carload of central-station men from Denver and points further west left Denver Saturday noon over the Union Pacific and Wabash routes arriving in St. Louis on Sunday evening. Mr. C. N. Stannard of the Denver Gas & Electric Company was in charge of the Denver arrangements.

The special from New York over the Pennsylvania was run as a section of the St. Louis Limited, leaving at 11 a. m. Sunday, and arriving at the Union Station shortly after 1 o'clock on Monday afternoon. The train was made up of eight cars, six of which were sleepers. Delegates were picked up en route at Newark, N. J., Philadelphia and Harrisburg, Pa. Mr. W. W. Porter, general passenger agent of the Pennsylvania Railroad, accompanied the party all the way to see that there was nothing lacking to make the trip a most enjoyable one. Delegates from the New York Edison, United Electric Light & Power Company of New York, Brooklyn Edison, Philadelphia Electric Company, Potomac Electric Power Company of Washington, the Public Service Corporation of New Jersey and the Consolidated Gas Light & Power Company of Baltimore, made up the greater part of the 88 passengers on this train.

The special convention train from New York over the New York Central ran as the second section of Southwestern Limited, leaving at 2:45 Sunday afternoon. It made such an excellent run that the party arrived at St. Louis about 15 minutes ahead of time. The train, which carried 140 passengers, was composed of 10 cars, including a dining and buffet car. A sleeper was picked up at Albany, another at Rochester, and a third at Buffalo. On behalf of the association, Mr. Hodskinson, of the Boston Edison Company, acted as master of ceremonies with the title of master of transportation. Messrs. E. J. Ohayer, Jr., general Eastern passenger agent, and G. W. Daily, looked after the comfort of the party on behalf of the New York Central lines. Mr. Ray D. Lillibridge, on behalf of the Wagner Electric Manufacturing Company, was something more than host; he had printed for the convenience of the party a souvenir pamphlet containing a complete list of passengers, giving car and section location, which proved to be particularly useful to those who wished to extend their acquaintance. The Wagner Company also contributed to the sociability and gaiety of the party by a generous distribution of refreshments, as notable for variety as for quality.

The exhibits are housed and all meetings held in the coliseum at the corner of Washington and Jefferson avenues. Festooned from the roof of this immense structure to a messenger wire connected between railway poles on the opposite side of the street are 12 streamers of red, white, and green incandescent lamps which illuminate the street and roadway in front of the building. Within was a scene of brilliance never before equaled in the history of the organization. The exhibition hall is charmingly arranged and decorated. The dome is completely hidden by a canopy of white and gold bunting draped in an easy curve from the center ridge, where are suspended three artistic tinted glass chandeliers each holding two hundred 100-watt tungsten lamps. Over the aisles skirting the inner rows of booths are six star-shaped fixtures fitted with tungsten lamps in prismatic glass shades. The booths themselves show skill and taste on the part of the designer and decorator. Through the aisles on either side are columns spaced 7 ft. apart with large colored tulips surmounting each. The column carries a wrought-iron bracket at the top with a rustic sign attached to it on which is painted the name of the exhibitor. The walls of the immense arena are covered with gold bunting with medallions of the N. E. L. A., suspended from the walls about every 15 ft. With such a handsome setting the various exhibits stand out to advantage.

Following the opening of the exhibits yesterday (Monday) evening, there was a reception by the officers of the association to delegates and visitors, on the stage back of the exhibition hall. In the receiving line were Mr. and Mrs. W. W. Freeman of Brooklyn; President Frank W. Frueauff and Mrs. Frueauff of Denver; Mrs. Annie D. Frueauff; Mr. and Mrs. John F. Gilchrist of Chicago; Mr. and Mrs. C. H. Holman, Mr. and Mrs. Henry H. Humphrey, Mr. and Mrs. W. A. Layman, Mr. W. N. Matthews, Mr. and Mrs. Alton S. Miller, Captain and Mrs. Robert McCulloch, Mr. and Mrs. T. M. Meston, Mr. and Mrs. F. E. Newbery all of St. Louis; Mr. and Mrs. F. M. Tait of Dayton, and Mr. T. C. Martin of New York. The reception was followed by a dance.

The first general session was opened Tuesday morning with an address of welcome by Hon. Frederick H. Kreismann, Mayor of St. Louis, who expressed the gratification of the city in being favored by the association as the twenty-fifth anniversary meeting-place. He referred briefly to the past history of the electrical industry and touched upon important work done by electricity in upbuilding St. Louis. He concluded by presenting to President Frueauff the key of the city. Mr. W. W. Freeman, of the Brooklyn Edison Company, then took the chair while Mr. Frueauff delivered his presidential address.

In opening his address Mr. Frueauff reviewed the history of the association and quoted from the *Proceedings* of the first meeting a number of statements, some amusing and others prophetic as to the future of electricity. At the end of the first year there were 62 members in good standing; at present the association has 823 company members and a total of more than 6000 members of all classes. He recommended the grouping of membership into several classes according to the population of the cities served by member companies, one class corresponding to 25,000 population, another to a population of from

25,000 to 100,000, and a third to a population in excess of 100,000. According to this plan, a topic of which the importance has a bearing on the size of the plant, may be discussed in one group, and the various committees may so arrange their work as to serve each of the several groups. The State and geographic sections have, he said, shown a most satisfactory growth during the year, and the hope was expressed that State sections may be soon organized wherever they do not now exist. Such sections should be of the highest value to small companies, as through their connection with the present independent State organization they would become automatically a part of the National Association, and receive benefit from the broad policy of the latter in the development and protection of the central-station industry. Mr. Frueauff reviewed in turn the work of the various committees, and expressed high appreciation of their efforts on behalf of the association and its members. In referring to the subject of conservation of natural resources, he said that much which has been appearing in the public press on the subject would appear to indicate a belief in some quarters that steps should be taken to curtail the development of the natural resources of the country. By the development of water-power resources which may otherwise be dissipated never to return, such as coal, wood and oil, are necessarily saved; but even more important is the conservation of time, the conservation of effort and the conservation of thought, in all of which electricity has played an important part. Referring to the supply of new capital to provide for a constant expansion of business, he said that by publicity great good has been accomplished, and that probably willingness to show facts has had much to do with the belief in the public mind that electric securities are now on a safe investment basis. He referred to the constant downward trend in the rates charged for electric service, which service is the one cheaper thing enjoyed by the public in these days of high cost of living. The central-station man has been satisfied with an increase in gross earnings from an increase in sales, and has given to the public the greater part of the benefit from this policy. After reviewing briefly the progress of the past, Mr. Freuauff referred to the future and said that we stand appalled at the tremendous amount of capital necessary to develop the opportunities which yet lie before us. The arid lands of the West and South will be made fertile, and unproductive lands in other sections will be made productive through fertilization electrically produced. Some of the steam roads of the country are now changing to electric power, others are considering the advisability of such a change, and in the city streets the future is only for the electric vehicle.

The address was referred to the following committee, who will suggest such action on the recommendations of the president as may be called for: Messrs. Samuel Insull, Chicago; C. L. Edgar, Boston, and M. C. Osborn, Spokane.

Mr. Alten S. Miller, president of the Union Electric Light & Power Company, St. Louis, and chairman of the entertainment committee, then announced the social features for the week, comprising an automobile ride through the residential section to Shaw's Garden on Tuesday afternoon, where tea will be served; a theater party for the ladies on Tuesday night; a visit to the Anheuser-Busch brewery on Thursday; a luncheon for the ladies at Glen Echo Country Club on Wednesday and visits to various clubs and power stations from time to time. On motion of Mr. W. C. L. Eglin, of Philadelphia, past-president, the secretary was instructed to forward a telegram to Mrs. Harriet Billings at her home in Arlington, Vt., expressing best wishes of the association and hope of speedy recovery from her illness.

Mr. H. O. Stewart, of Rochester, N. Y., then presented the report of Mr. John C. Parker, of the Rochester Railway & Light Company, editor of the Question Box. Mr. Parker reported that the work on the Question Box has now attained such proportions that a permanent editor should be engaged with headquarters at the offices of the association. The report on Question Box Revision by Mr. Paul Lupke and Mr. Alex. J. Campbell, former editors, was presented by Mr. Campbell. The report states that the task of the revision of the Question Box is becoming less and less a mere revision, and more and more the development and production of a central-station operators' handbook, which should be to the whole field of central-station work what the Solicitor's Handbook is to the "new business" department. It is hoped to have the work completed in time for it to form part of the printed *Transactions* of the St. Louis Convention.

Mr. T. C. Martin presented his report as committee on progress, which, as printed, comprises 74 pages, and gives an excellent résumé covering every phase of central-station activity. The aggregate of present investment in the central-station business is stated to be $1,500,000,000, with an income of $300,000,000 gross. Referring to the great proposition of small central stations, he said that the entire State of New York, which has now 358 stations, could easily be covered by 25 plants having a distributing radius of 50 miles each. The report of the Public Service Commission of New York indicated that a large part of the small companies show a deficit each year. Commenting on the present status of water-power conservation policy, he said that the realities of the situation are serious, for a definite policy of restriction is rapidly shaping up that bids fair to check development. Referring to the electric automobile, it was stated that 20,000 electric vehicles are now in use in this country, the annual energy consumed by them being valued at over $2,000,000.

Mr. T. C. Martin then presented, in the absence of the author, a paper by Mr. Paul Lupke, which dealt in a witty manner with some of the faults of superspecialization. While admitting the necessity under modern industrialism of the benefits of intense specialization, one's back should not be bent forever in one narrow furrow; and any employe who puts the interests of the department to which he belongs above the interest of the company as a whole, makes it impossible for himself to be a good employe. Such a condition tends to diminish service toward the company as a whole, and also to develop an exaggerated ego and produce little men. There are, he said, more little jobs than little men and always more big jobs than big men, while in the very nature of things big jobs must be above any one single department. The fact, he said, that corporations have no souls imposes upon every employe, high or low, the duty to demonstrate clearly on every occasion that he has one.

Mr. Lupke's witty production was received with the usual laughter, applause and enthusiasm which have greeted his similar contributions to opening sessions at a number of past conventions, and a rising vote of thanks passed to the author.

Mr. H. H. Scott, of the Doherty Operating Company, and chairman of the membership committee, presented a report showing an expansion in 10 years from 200 to 5523 members,

and a net gain for last year of 2386 members of various classes. The report closed with a résumé of the methods used in the successful membership campaign of last year. The committee recommends aggressive methods toward the formation of additional geographic sections, following out the plan outlined by the committee on State and company branches last year.

Mr. Dudley Farrand, past-president and the official representative of the association on the National Conservation Commission, was unable to be present owing to an accident confining him to bed. His report, read by Mr. W. B. Robbins, of St. Louis, stated that owing to the fact that the National Conservation Commission lost its legal existence by act of Congress, the association's representative was left with empty title. During the year no national meetings were held, but the National Conservation Association has been organized with headquarters in Washington, which will carry on its work through voluntary contributions, this work consisting largely of a series of bulletins calling attention to particular phases of conservation. Agents are delegated to watch bills in Congress, and at the present time the association is trying to prevent the passage of the Senate bill giving the control of water-powers on public domains to the States in which they are located. No action being demanded of the association at the present time, Mr. Farrand reported progress, and the report was referred to the executive committee.

Mr. John R. Bailey, of the Consolidated Gas, Electric Light & Power Company, Baltimore, chairman of the accounting committee, submitted a report summarizing the work done last year and reserving other matters for discussion in the accounting sessions. The committee has worked out a classification of accounts for smaller companies which will be in shape for distribution to members in July. The classifications adopted at the 1908 and 1909 conventions are now published in book form by the association for $1.

Upon the conclusion of Mr. Bailey's report the convention adjourned to 2:30 p. m. of this afternoon (Tuesday) when in a general session the following report and papers will be presented: Report of lamp committee, Mr. W. F. Wells, Brooklyn Edison Company, chairman.—Periodic lamp renewals and customers' service inspection, by Mr. A. G. Strickrott, Schenectady Illuminating Company.—Magnetite and flaming arcs vs. open and enclosed carbon arcs for street illumination, by M. W. D'A. Ryan, General Electric Company.—New form of tungsten lamp, by Mr. C. F. Scott, Westinghouse Electric & Manufacturing Company.—High-efficiency lamps, by Mr. S. E. Doane, chief engineer National Electric Lamp Association.

Dinner to the Visiting Representatives of the National Laboratories.

As was described by Dr. E. B. Rosa in our issue of April 7, some important international work in the elaboration of the specifications for arriving at the concrete international ampere and volt has lately been carried on at the Bureau of Standards in Washington. The representatives of the national laboratories taking part in this work are Prof. Dr. W. Jaeger from Charlottenburg, Prof. F. Laporte from the Laboratoire Central of Paris, and Mr. F. E. Smith from London.

A dinner in honor of these visitors to our Bureau of Standards was given at the Hotel Astor, New York, on May 17, under the auspices of the United States National Committee of the International Electrotechnical Commission. In addition to the three foreign guests, Prof. Elihu Thomson, president of the commission; Dr. Edward Weston and Dr. H. S. Carhart were invited. Participating with the United States committee members were Mr. J. J. Carty, vice-president of the American Institute of Electrical Engineers; Mr. F. W. Frueauff, president of the National Electric Light Association; Dr. E. P. Hyde, president of the Illuminating Engineering Society, and Mr. T. E. Murray, president of the Association of Edison Illuminating Companies. The three last-named societies have by their contributions of money taken an active part in the visit and co-operative work of the three national representatives.

Representing the United States National Committee were President A. E. Kennelly, Director S. W. Stratton, of the Bureau of Standards, and Messrs. Louis Bell, A. W. Berresford, Gano S. Dunn, John W. Howell, Dugald C. Jackson, Malcom McLaren, William Maver, Jr., William McLellan, H. St. Clair Putnam, William L. Robb, Edward B. Rosa, David B. Rushmore, Clayton H. Sharp, Samuel Sheldon and Charles P. Steinmetz.

Dr. Kennelly, acting as toastmaster, read communications of regret from Professor Thomson and Dr. Carhart, the former being prevented from attending through illness, and the latter by absence in California. A wireless telegram of greeting was also received and read during the dinner from Mr. J. W. Lieb, Jr., the chairman of the dinner committee, who had been compelled by business to sail that morning for Europe.

In introducing the speakers, Dr. Kennelly referred to the importance of precision in international standards on the scientific, industrial and social development of the civilized world.

Dr. Weston described his early work with the Weston standard cell, undertaken about 20 years ago, and made a plea for concentration of effort upon the correction of the international units to their true values in terms of absolute c.g.s. units.

Professor Jaeger, M. Laporte and Mr. Smith spoke of the work on which they were still jointly occupied, expressing the hope that it would lead to fruition. They pointed out that the magnitude of outstanding discrepancies between the concrete international volt, ohm and ampere standards, as prepared in the different national laboratories of the world, were already too small to be worthy of serious consideration by electrical engineers.

Dr. Steinmetz pointed out that physical standards had already passed beyond the stage at which they were kept within national laboratory limits. He said that in future more and more international co-operative work might be expected, and that the higher stages in the development of physical standards rendered such international co-operation imperative.

Dr. Stratton spoke with great hopefulness of the very important work which the visiting physicists were doing in Washington, and said that by working side by side in this manner they were able to approach the required goal of precision more rapidly in a few weeks than would be possible in months or years of isolated endeavor. He hoped that such international co-operative work would become the rule rather than the exception in all lines of precise national standardization.

Pacific Coast Power Plant Trip.

As a climax to a most successful meeting of the American Institute of Electrical Engineers, held under the auspices of the high-tension committee, at San Francisco, a special trip was arranged for the visiting members to inspect some of the more important nearby hydroelectric developments on the Pacific Coast and other engineering projects which must be seen to be realized by the engineers east of the Mississippi.

The Pacific Gas & Electric Company, the Great Western Power Company, and the Northern Electric Company, were the hosts on this occasion and showed broad Western hospitality by extending every possible courtesy in the way of transportation, hotel accommodations, etc., and attending to every detail to make the trip smooth and comfortable. The Eastern visitors were especially fortunate in being included among the guests of Mr. A. H. Babcock, electrical engineer of the Harriman property, in his private car.

The party left San Francisco Sunday night, May 8, in special cars, arriving in Chico Monday morning. Here they were met

by special train of the Butte County Railroad, which by the courtesy of the officials of the Diamond Match Company, conveyed the party to Magalia, where mountain stages were waiting to take them to the DeSabla power house of the Pacific Gas & Electric Company, 8 or 10 miles distant.

Although the weather was stormy, there was no discomort, as the hosts had the forethought to provide each member of the party with an oilskin slicker. From the reservoir, the majority of the party walked, slid or fell down the pipe line and penstocks to the power house, 1600 ft. below. This plant is one of the high head-type and has a capacity of 20,000 kw, the Pelton wheels operating under a head of 1600 ft. or about 700 lb. pressure at the nozzle.

After a very bounteous luncheon, served in the company's hotel, the party drove 20 miles back to Chico, stopping at the Centreville power house on the way. At this station the wheels are of the horizontal turbine type and operate under 800 ft. head. In both these power houses the e.m.f. is stepped up to 60,000 volts and fed into the general transmission network of the Pacific Gas & Electric Company. On returning to Chico Mr. P. M. Downing, transmission engineer of this company, entertained the party at dinner at the Diamond Hotel.

On Tuesday morning the shops of the Northern Electric Railway Company were visited, after which Mr. Babcock's car was attached to a high-speed electric car and hauled to Oroville. The average speed on this trip was 45 miles per hour, and in several cases a speed of over 50 miles was shown on the indicator for considerable stretches. At Oroville a transfer was made to a special train on the Western Pacific Railroad for a trip along the Feather River to the dam and power house of the Great Western Power Company at Great Bend.

At the first point visited, this company is constructing a dam 150 ft. high, which will give a total head at the power house of 550 ft. This dam is primarily for the purpose of increasing the head, and another one is being built further up the stream for water storage. After luncheon at the company's hotel, the power plant, 13 miles downstream, was visited. The present installation consists of four 10,000-kw generators connected to vertical turbine wheels. These now operate at about 420 ft. head, but with the completion of the work contemplated, the rating of these wheels will be increased 25 per cent and four additional units installed, making the total rating of the plant 100,000 kw. At these plants some of the party had their first experience in crossing canons on skip hoists and felt rather far from home when suspended 400 ft. above the seething torrent. The transmission lines of this company are operated at 100,000 volts, but tie in through transformers with a 60,000-volt transmission network of the Pacific Gas & Electric Company. Sacramento was reached about 10:30 in the evening, where the party remained over night.

Early Wednesday morning a start was made in automobiles which had been shipped from San Francisco for the purpose by the lighting company. The first stop was made at the Brighton substation of the Great Western Power Company, at which station the 100,000-volt potential is reduced for distribution. From thence to the old original station at Folsom, where the machines are of the revolving armature type. These machines, however, are still in active operation and run in multiple on the same network with the modern plants. The dam for this plant is located within the boundaries of the State prison, to which the party was conveyed on gasoline speeders and through which they were escorted by the warden. Luncheon was served on the veranda of the cottage of the Natomas Consolidated Company, Mr. DeSabla, the engineer, who located and designed the DeSabla power house, being the host.

A short auto ride brought the party to one of the Natomas gold dredgers, which was digging up abandoned vineyards at the rate of 500 cu. yd. per hour and which pays a profit if 7 cents worth of gold is extracted from each bucketful of soil and gravel. As a by-product the gravel and stones are crushed and used for road-making or railroad ballast, which in some cases is as valuable as the gold. These dredgers require from 30 kw to 500 kw apiece, and as they operate about 22 hours per day, they give the stations supplying them an extremely high load factor. The auto trip back to Sacramento over a perfect oiled road, with dinner served on the train, returning to San Francisco, completed one of the most interesting and instructive trips ever tendered to the members of the American Institute of Electrical Engineers.

For those who had never been west of the Rocky Mountains it was a revelation to see the immensity of the problems presented to the Pacific Coast engineers and the broad, comprehensive manner in which they have been handled and yet with due regard for the minor details. Their work shows that theory has not been overlooked, and yet everything has been done with a view of a profitable return on the capital invested. Those who failed to take this trip must ever regret an opportunity lost to inspect what Western engineers have done for the profession. The members of the party were as follows:

Mr. A. H. Babcock, electrical engineer Harriman properties; Mr. S. K. Colby, Pierson, Roeding & Company; Mr. C. Cheever, engineer Telluride Power Company, Utah; Mr. P. M. Downing, transmission engineer P. G. & E. Company; Mr. J. P. Edwards, mechanical and electrical engineer Northern Electric Company; Mr. J. B. Fiskin, general superintendent Washington Water & Power Company, Seattle; Mr. B. H. Greiser, general superintendent Washington Water & Power Company, Seattle; Mr. Fred Hamilton, chief engineer Mt. Whitney Power Company, Visalia; Mr. J. Harrisburger, Seattle; Mr. Paul Lebanbaum, electrical engineer Oregon Short Line; Mr. F. J. Lisburger, distribution engineer P. G. & E. Company; Mr. S. J. McMean, vice-president Home Telephone Company, San Francisco; Mr. W. Meredith, construction engineer Northern Electric Company; Mr. Geo. R. Murphy, Pierson, Roeding & Company; Mr. H. E. Shedd, Great Western Power Company; Mr. F. H. Varney, operating engineer P. G. & E. Company; Mr. W. F. Wells, general superintendent Brooklyn Edison Company.

Adjustable-Speed Single-Phase Motors.

In three patents issued to Mr. Val. A. Fynn, of the Wagner Electric Manufacturing Company, on May 3 and another on May 10, are described several forms of single-phase motors of the same general class as those previously patented by Mr. Fynn, as noted in our issue of April 14.

Two patents issued on May 3 relate to the arrangement illustrated in Fig. 1, which shows a commutator motor of the induction type, the induced and commuted winding of which is closed over brushes and along more than one axis per pair of poles. The arrangement is such that the motor may be operated at any desired constant speed quite independently of the frequency of the supply and the number of poles of the motor. The speed can be adjusted at will by varying the connection to the stationary tertiary winding, which is joined to exciting brushes on the secondary commuted winding. The

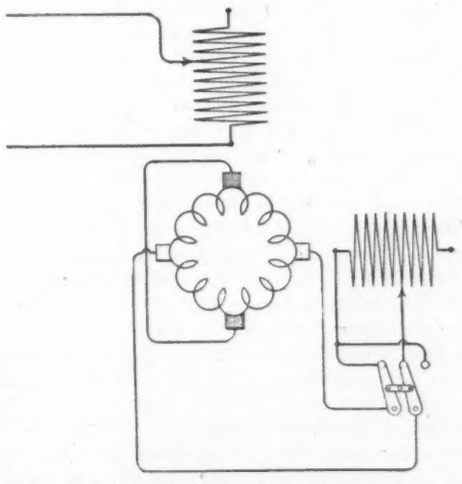
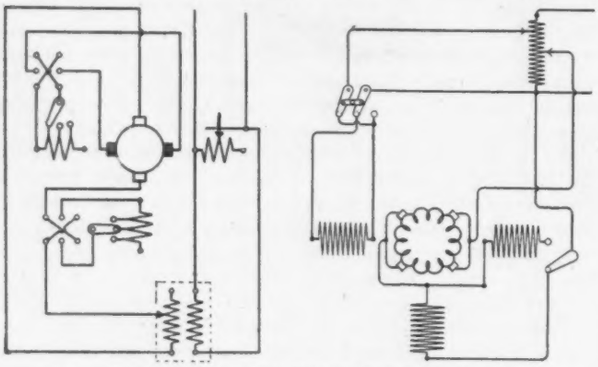


Fig. 1—Adjustable-Speed Single-Phase Motor.

power-factor of the machine may be improved by including in the working circuit of the rotor an e.m.f. in time-phase quadrature with that impressed on the main stator winding, or by including in the exciting circuit of the rotor an e.m.f. approximately in time-phase with the e.m.f. impressed on the main stator winding.

A motor closely related to the one just described is illustrated in Fig. 2. In this machine use is made of a stator coil placed in direct magnetic line with the working commutator brushes for the purpose of adjusting the e.m.f. introduced into



Figs. 2 and 3—Adjustable-Speed Single-Phase Motors.

this brush circuit and thereby fixing the speed at any desired constant value. A separate stator coil is placed in magnetic line with, and connected in series with the exciting brushes, for the purpose of improving the power-factor of the machine, while the main stator coil can be adjusted to obtain proper commutation conditions.

An additional modification of the single-phase commutator motor designed for adjustable-speed operation is shown in Fig. 3. The machine is so operated that it generates its own exciting e.m.f. The windings are so arranged that there are produced two alternating fields displaced in time-phase and electrical space position, thereby creating a revolving field and improving the commutation. Under starting conditions use is made of a special winding which is disconnected under running conditions, the rotor circuit serving to maintain the proper magnetic relations when the machine is under speed.

Ductile Tungsten.

In the issue of May 12 an abstract appeared of a paper by Dr. C. G. Fink, of the Research Laboratory of the General Electric Company, at Schenectady, on "Ductile Tungsten," the paper having been presented before the recent convention of the American Electrochemical Society. Below is given an abstract of a paper on the same subject presented last week before the American Institute of Electrical Engineers by Dr. W. D. Coolidge, also of the Schenectady Laboratory:

Dr. Coolidge stated that when work on the production of ductile tungsten was first started in the laboratory, not only was there nothing in the past history of tungsten for encouragement, but, in the natural periodic system of the elements, the metal belonged to a family no member of which had been brought into a ductile state. The other members of the family are chromium, molybdenum, and uranium, elements which had always been characterized by hardness and brittleness. A study of the periodic system shows that, in a general way, elements of the same family do resemble one another in point of ductility, as well as in their other physical and chemical properties. For example, copper, silver and gold are all in one family and are all very ductile. Little encouragement, moreover, could be drawn from the achievement of Dr. von Bolton with tantalum, because of the fact that this element is in a different family, and the two families differ markedly in both physical and chemical characteristics.

A number of experiments were described which, while leading to several new and valuable methods for producing tungsten filaments of the usual quality, did not give much promise for the solution of the problem of obtaining a ductile tungsten filament. They were, however, in one respect instructive, for they enabled a complete removal of the foreign elements, at least so far as analytical tests showed, with the final high temperature treatment of the filament. This seemed to indicate that one either did not need to worry about contamination from such elements, or else that brittleness was due to traces of impurity so minute as to escape detection by our analytical methods.

In the mechanical working of pure tungsten a great impetus was received by the discovery that an ordinary, dense, well-sintered, tungsten filament can be easily bent and put into various forms, and otherwise manipulated at temperatures well below redness, and even below the temperature at which appreciable oxidation takes place. This helped in two ways. First, it reduced the temperature at which mechanical working operations could be carried on, and, second, it gave a means of recognizing which of the mechanical and chemical processes involved in the experiments were leading nearer to the goal. Anything which reduced the temperature at which the metal could be permanently bent was, clearly, an aid.

It was found that steps tending to the elimination of the last traces of certain impurities did greatly improve the resulting product. While it may be true that certain impurities present in small amount are harmless, or even helpful, certain other impurities were known to be detrimental. It was also found that a certain micrographic structure, in the initial tungsten rod, was conducive to mechanical working and to ductility in the resulting product. Once arrived at the point where mechanical working was easy and where there was a certain amount of ductility in the product even when cold, the development became more rapid. It was aided by the construction of more refined apparatus, in the design of which care was taken to guard against the taking up of impurities during mechanical reduction processes, both from the atmosphere in which the work is carried on and from the surfaces of the tools.

Hand in hand with this improvement on the mechanical side has gone the work on greater chemical purity of the metal at starting. One of the difficulties in purifying tungsten has been due to the fact, which has been pointed out by Smith and Exner and others, that tungstic acid is prone to form difficultly separable complexes. Because of this tendency, especial care must be taken with regard to the purity of the reagents used, as otherwise recrystallization beyond a certain point does not result in corresponding purification.

The knowledge obtained from the various lines of research carried out now makes it possible to prepare tungsten which can be mechanically worked without more difficulty than would naturally attend the manipulation of very fine wire. The product is a perfectly pliable ductile wire, which has the strength of steel. It gives a lamp which is strong and whose filament retains its ductility throughout the life of the lamp.

The following data on the drawn wire, obtained from measurements made in the laboratory by Dr. Colin G. Fink, were given:

Diameter (In Inches)	Tensile Strength (Pounds per Sq. In.)	Specific Gravity
.150	.....	19.30
.005	490,000	.....
.0028	530,000	.....
.0015	600,000	20.19

The electrical resistivity at 25 deg. C., expressed in microhms per centimeter cube, is, for the hard-drawn wire, 6.2, and, for the same anealed, 5.0. The temperature coefficient of electrical resistivity between 0 deg. C. and 170 deg. C. is 0.0051 per degree Centigrade.

The above values, with the possible exception of the temperature coefficient, are somewhat dependent on the early history of the wire from which they were determined.

In conclusion, Dr. Coolidge stated that the work outlined in the paper is the result of the close co-operation of about 20 trained research chemists, with a large body of assistants, in the Research Laboratory, who received from the factory organization all of the mechanical and electrical assistance they could use, and were assisted in no small measure by the staff of the incandescent lamp factory.

Tungsten Lamps.

Many interesting points relating to tungsten lamps were brought out in a discussion of a paper on the subject presented by Mr. John W. Howell before the American Institute of Electrical Engineers, on May 17, as abstracted on page 1248 of our issue for May 19. Dr. Clayton H. Sharp called attention to the advantageous features of the lamps for street lighting, especially when equipped with reflectors for redirecting the light flux which would otherwise be wasted. He showed certain current and voltage curves of tungsten lamps indicating that the current leads the voltage slightly on account of the great positive resistance-temperature coefficient of the filament.

Mr. J. B. Taylor remarked that the low resistance of tungsten filaments when cold compared with the hot resistance may introduce troublesome conditions upon the opening of circuit-breakers in lighting feeders, by reason of the enormous momentary overload to which the system will be subjected when the circuit is again closed.

Mr. Farley Osgood expressed the opinion that, from a multiple-lamp standpoint, it is an open question whether the metal-filament lamp should be used on a free-renewal basis unless the operating companies decide for themselves it is desirable to spend a considerable additional sum on the incandescent lamps for the sake of the various benefits which accrue to the consumer in the use of the metal-filament lamp. That statement applies wholly to lamps in commercial service. On the street-lighting service the condition is almost entirely changed. The tungsten filament lamp can be safely said to average a life of 1500 hours, so that its use is equal to, or better than, the carbon series filament lamp, the renewals are less frequent per year and the financial results are beneficial.

Mr. Howell referred to some remarkable relations between the specific brilliancy and specific consumption of various types of lamps. He said that under normal conditions of operation the tungsten filament gives twice as much light per unit of surface as does the carbon filament at its normal specific consumption. When the two lamps are operated at the same specific consumption, the conditions are reversed, the carbon filament giving twice as much light per unit of surface as does the tungsten filament. This relation is an indication of the reasons of the efficiency of the tungsten lamp. There is a strong physical indication that at the same specific consumption the carbon filament is much hotter than is a tungsten filament. At its normal specific consumption of 2 watts per candle, the light per unit of surface is the same for a tantalum lamp as that for a carbon lamp operated at 3.1 watts per candle.

Regenerating Carbon-Filament Incandescent Lamps.

A patent was granted, May 17, to E. A. Kruger, of Seehausen, Germany, on a method of regenerating carbon-filament incandescent lamps and retaining the original filament. The bulbs of carbon-filament lamps become blackened by very fine particles of carbon thrown off from the filament, which are deposited on the inner wall of the glass bulb. According to the method of regeneration covered by the patent, after the bulb has been opened and a tube attached by fusion, the former is highly heated by an open flame until the black coating of the glass wall burns away. The bulb is then exhausted and a suitable hydrocarbon introduced. The filament is then flashed; that is, an electric current is sent through it in the atmosphere of hydrocarbon, which latter is decomposed and carbon is deposited in a very dense form. The flashing is continued until the filament has acquired a predetermined resistance, when the lamp is again exhausted and sealed. It is said that the lamp is then ready for use, and is exactly as good as a lamp having a perfectly new carbon filament.

Southwestern Gas and Electric Convention.

More than 200 central-station, electric-railway and gas-plant operators from Texas and Louisiana attended the sixth annual convention of the Southwestern Gas and Electrical Association at Beaumont, Tex., May 12 to 14. The convention headquarters were at the Crosby Hotel, the meetings were held in the rooms of the local B. P. O. E. Club, and the supply men and manufacturers' exhibits were installed in the Kyle Opera House Building. The city and citizens of Beaumont welcomed the visitors in characteristic Southern fashion, decorating the streets with festoons of lights in their honor, and plying them with entertainment when not engaged in convention business.

The first day's session, Thursday, was opened with an address of welcome by Hon. D. P. Wheat in behalf of Mayor E. A. Fletcher, of Beaumont. President W. B. Head, in the chair, called for a response by Mr. H. S. Cooper, of Galveston, Tex. In his presidential address, which followed, Mr. Head called attention to the phenomenal growth in the membership and in the efficiency of the association in developing its objects and purposes. In referring to the educational work the members can yet do, the president declared that public-service corporations are not properly understood by the people, and are, therefore, subject to criticism and distrust, more than any other kind of business. Relating the advantages of mutual discussion among public-utility operators, Mr. Head said in this electrical age in which we live the successful man must acquaint himself with what the world is doing. He also referred to the volume of valuable material and information supplied by the Southwestern Association's publications and proceedings.

The establishment of definite headquarters at Dallas, Tex., and the employment of a permanent paid secretary to give all or a large part of his time to the work, has been one of the best steps made by the association, thought the president. The expenses of the secretary's office and salary are defrayed by assessments among the member companies, each contributing an amount proportional to its gross receipts. This plan of payment has proved a great success, and few members are in arrears.

The smaller central stations of the Southwest are just awakening to the fact that their methods of accounting are not adequate, and, according to President Head, a standard system of bookkeeping is one of their first needs. Internal-combustion engines and producer plants are subjects of the liveliest interest to the smaller companies, to judge by the inquiries received at association headquarters. Gasoline lighting competition, continued the president, is one of the most serious problems now facing the electric-light manager in the small town. Proper illuminating engineering, conserving the large amount of light ordinarily lost and wasted in careless installations, will, he believes, make the tungsten lamp as considerable a superior in point of economy as in other respects, compared with the gas vapor mantle.

The coming year brings the Legislature together in Texas, and while President Head fears no immediate danger from the passage of laws unfair to corporation interests, the latter having now been rendered nearly immune, he remarked, by attentions from almost every form of government, town, county and State—yet he foresees the possible agitation for a public-service commission, and urged attention toward meeting the public half way in securing a just and equitable statute enabling such a commission. President Head sees no use for such a law or commission in Texas, but demands in any event "regulation" by an experienced and intelligent commission rather than being "managed" by incompetent and ignorant politicians. The ad-

dress closed with a reference to the needs for tact, courtesy and capability on the part of company employes, pointing out that honesty in a company's policy is always essential.

Mr. O. Bracker, superintendent of meters of the Brush Electric Light & Power Company, Galveston, Tex., next read a paper on "The Watt-Hour Meter in Actual Operation." This discussed the possible errors of meters, their sources and methods of connection. General types of commercial meters were described, and the inherent advantages of each outlined. The practices of various companies in testing customers' meters, and especially the experience of the Galveston Brush Company, were also described. The introduction of tungsten lamps, the speaker brought out, has made the sensitiveness and accuracy of meters on small loads essential to a fair recompense for electric service.

Mr. H. S. Cooper, manager of the Galveston Electric Company, then presented a paper embodying "Some Suggestions for a Standard Rule Book for Operation of City Cars." Mr. W. B. Tuttle, of San Antonio, Tex.; Mr. W. L. Wood, of Texarkana, Ark.; Mr. E. T. Moore, of Dallas, Tex.; Mr. David Daly, of Houston, Tex.; Mr. T. C. Brown, of San Antonio, Tex.; Mr. H. S. Potter, of El Paso, Tex.; Mr. W. W. Loomis, of Dallas, Tex., and Mr. M. J. Lofties, of Sherman, Tex., took part in the discussion which followed.

Dr. A. C. Scott, professor of electrical engineering in the University of Texas, at Austin, was called to the chair to preside at a discussion relating to the Question Box of the association. In the solicitation of this material hereafter, he announced, the plan will be followed of asking that each answer be sent in directly to the editor of the Question Box, instead of accompanying the original inquiry on its trip around to other members.

In answer to an inquiry asking if trouble had been experienced in properly balancing three-phase circuits, Mr. W. B. Head, of Stephenville, Tex., said he knew of no such difficulty. Mr. Oscar Pearson, of Ballinger, Tex., testified that he had found it necessary to remove all lighting to one phase, utilizing the three only for motors. With a Tirrill regulator, this operation is satisfactory. Prof. A. C. Scott, of Austin, Tex., told of a method of so connecting new customers as to make a balanced three-phase load.

Mr. David Daly, of Houston, Tex., asked for the experience of other companies with the new State rating board which confirms insurance rates. Mr. H. S. Cooper pointed out the unfairness of charging a basic rate of 50 cents or more, for theoretically non-destructible plant buildings of perfect construction. If investigation proves that this enormous rate, he said, is totaled by the simple charges of accounting and overhead expenses on the part of the insurance companies, it would be cheaper for the properties to carry their own insurance. Mr. S. C. Trimble, of Orange, Tex., doubted that any rate had yet been fixed by the insurance board, and quoted several conflicting rates given on his combination plant. Mr. Cooper went on to show that the higher rates charged by the incorporated companies probably result from carelessness in the operation of their business, and in their failure to inspect closely, as do the mutual companies. If properly carried out, such inspection would enable the old-line companies to duplicate the latter rates, he believed. Mr. Reed, an insurance inspector present, declared that on the whole, he believed that the work of the State insurance board had lowered the rates, and had improved inspection. Mr. J. E. Carroll, of Beaumont, Tex., testified that after receiving a reduction in rates from $2.50 to $1.50, the State board had instructed this to be raised to $1.75, but had allowed, through the correction of minor defects, such as closing of oil cans, removal of transformers, installation of fire extinguishers, etc., the final reduction of the rate to $1.01.

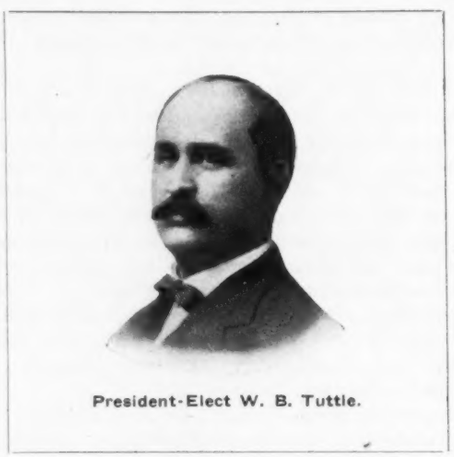
Prof. Scott then invited accounts of the experience of members in burning Texas lignite coal with Dutch-oven boiler settings.

On Friday morning, Mr. David Murdock, of the Pay-As-You-Enter Car Corporation, of New York, N. Y., opened the program with a paper relating "Observations on Pay-As-You-Enter Cars." Mr. Murdock discussed the advantages of this method of fare collection, and was followed by the comments of Mr. H. S. Cooper, Prof. A. C. Scott and Mr. E. T. Moore. This discussion also brought up the question of allowing passengers to enter by the front door of the car, and the proper crossing for stops at street corners.

Mr. Harry Pennington, of the Pennington Company, of Houston, Tex., next read an excellent paper on "Condensers for Small Central Stations" in which he discussed the results obtained with the new rectangular jet-type condensers manufactured by several companies. The paper described the fuel saving and other advantages of condensing operation, and compared tests of the old and new types of jet condensers. The discussion closed with advice on the arrangement and lay-out of plants, and the use of cooling towers.

During this Friday morning session, those members of the association especially interested in matters of gas manufacture and supply held an independent session and listened to the following papers: "Dry-Gas Meters in Actual Operation," by Mr. P. E. Nicholds; "Individual Factors in the Development of the Gas Business," by Mr. M. T. Walker, and "Proper Operation of Water-Gas Apparatus," by Mr. M. J. Dewey.

The convention sessions closed Saturday morning with a business meeting at which the reports of officers and committees were read. Treasurer A. E. Judge, of Tyler, Tex., showed by his report that the finances of the association are in a healthy condition. Secretary D. G. Fisher, of Dallas, Tex., outlined the work of his office during the year, and reported a total membership of 315 in the association, the 1910 convention registration being 244. The recommendation of the by-laws committee extending membership to include operators of water-works plants in the Southwest, was approved by the association. The committee on resolutions tendered the thanks of the members to the Beaumont citizens, and to its Beaumont members, and others who had contributed to the success of the present convention. The association also authorized a memorial to Congress approving a deep-water entry for Beaumont.



President-Elect W. B. Tuttle.

In the selection of officers for the coming year, Mr. W. B. Tuttle, of San Antonio, Tex., was made president; Mr. J. E. Carroll, Beaumont, first vice-president; Mr. E. T. Moore, Dallas, Tex., second vice-president, and Mr. D. G. Fisher, of Dallas, Tex., third vice-president. Mr. A. E. Judge, of Tyler, Tex., was returned as treasurer, and Mr. W. B. Head, of Stephensville, Tex., was elected secretary. The finance committee is made up of Mr. A. T. Lloyd, Shreveport, La.; Mr. W. A. Guthrie, San Angelo, Tex., and Mr. H. S. Potter, El Paso, Tex. The advisory committee comprises: Mr. E. S. Fletcher, Temple, Tex.; Mr. Oscar Pearson, Ballinger, Tex.; Mr. F. I. Storm, Amarillo, Tex.; Mr. M. T. Walker, Beaumont, Tex.; Mr. T. Cook, Waxahachie, Tex.; Mr. W. W. Loomis, Dallas, Tex.; Mr. J. B. Earl, Waco, Tex.; Mr. W. S. Rathell, Waco, Tex., and Mr. W. C. Torbess, Ft. Worth, Tex. The executive committee comprises President Tuttle, ex-President Head, Vice-

Presidents Carroll, Moore and Fisher, and Mr. F. B. Johnson, of Stamford, Tex.; Mr. W. L. Wood, of Texarkana, Ark.; Mr. C. H. Dunbar, Houston, Tex., and Mr. L. L. Stephenson, of Big Spring, Tex.

A ballot of the members present showed the majority to favor Houston against San Antonio as the next convention meeting place. The meeting place and date will be decided later by the executive committee.

Beaumont entertained its visitors with proverbial Southern hospitality. The city streets and buildings were festooned with hundreds of incandescent lamps, and decorated with flags in their honor. On Thursday afternoon following the convention session, the guests were taken in a procession of 50 automobiles to visit the great irrigation pumping plant, six miles from Beaumont, which renders 32,000 acres of lands fertile for rice growing. Returning, the parties viewed the oil fields and visited the Country Club where refreshments were served. In the evening there was a theater party for all. On Friday, two pleasure yachts took the visitors on a cruise down the beautiful Neches River. Opportunity was also given for inspecting the United States revenue cutter *Windom* at the Beaumont dock. Entertainment of the visiting ladies was taken in charge by a committee of local ladies. Mr. J. E. Carroll, of the Beaumont Ice, Light & Refrigerator Company, was in charge of the matters of entertainment of the convention.

Friday evening the Sons of Jove of the Southwest held their annual rejuvenation, and initiated 42 novices into the order, the class being the largest ever inducted into this division where the Sons of Jove was first founded a number of years ago. Following the initiation ceremonies, an elaborate banquet was served.

The Southwestern convention would not be complete without its annual badger fight. The 1910 ceremony was given Saturday morning for the benefit of a gas-appliance salesman, who later left the city on the first train.

Massachusetts Supreme Court Upholds Use of Stickers on Telegrams.

The Supreme Judicial Court of Massachusetts has issued a decision sustaining the plaintiff in the case of William M. Vermilye vs. Postal Telegraph-Cable Company, the issue being the right of the company to refuse to accept a message carrying a sticker of the plaintiff's which warned the company of the financial loss to him liable upon incorrect or retarded delivery. The sticker bore the words: "Notice is hereby given that this is a business message, and that failure to deliver it promptly and correctly is likely to cause the sender financial loss. Further particulars will be furnished, if desired, on application to the sender at 116 Bedford Street, Boston." The court points out that seemingly both parties were trying to protect their respective rights and interests in reference to the liabilities growing out of this kind of a contract. There was an absolute refusal of the defendant to receive and transmit the message while it was accompanied by such a notice. Nothing was said by either party about having the message repeated or insured, as it might have been under the regulations of the company upon payment of an additional price. His refusal was without reference to the particular form in which the notice was presented. There was no tendency to confuse the operator, nor any increased probability of error or delay in the transmission.

The court holds that the defendant was engaged in a quasi-public employment, to be carried on for the accommodation of the community, with a view to the general benefit. It had no right to refuse to receive a proper message for whose transmission payment was tendered. The only question raised is whether the giving of the notice by the plaintiff relieved the defendant of its obligation to transmit the message. It was certainly the right of the plaintiff to inform the defendant as to the nature of the message and its importance from a financial point of view, in order that the nature and particulars of its undertaking might be understood by the defendant, and the obligation it incurred in reference to damages for a breach of the contract. Such a notice would furnish no justification for a refusal to send a message, whether it might or might not be a sufficient reason for charging something more than the lowest rate established for the transmission of messages. It was intended to show that the damage for a failure properly to send and deliver the message would probably be substantial, and, under the statute and the rules and regulations of the company, to create a liability that might reach the sum of $100. Such a liability might exist without a special notice if the language of the message sufficiently indicated the importance of a prompt delivery of it, and the loss that would result from a failure to deliver it promptly. Whatever negotiations or proposals or limitations on the part of the defendant might have been waranted by the giving of the notice, the absolute refusal to receive and send the message was unreasonable and justified a finding for the plaintiff either under the statute or at common law. The defendant's action was admittedly willful. The defendant's argument upon this branch of the case is chiefly in the nature of an assumption that his conduct was reasonable, in reference to the different rates charged, depending upon whether the message was sent in the usual way or was repeated or insured, and in reference to the attempt to impose upon the defendant by the notice a liability that otherwise would not exist. This argument is answered by the findings of the lower court that the refusal of the defendant was absolute, and without reference to the rates that might be charged in view of the different degrees of responsibility that might be assumed for a failure to transmit the message correctly and promptly. Exceptions overruled.

Wisconsin Rate Commission News.

The Eastern Wisconsin Telephone Company has been authorized to increase its rates on residence and business telephones from $1 and $1.25 per month, respectively, to $1.25 and $1.50, respectively. The additional revenues accruing under the new schedule are made necessary by the additional expenses which will be involved in the improved and extended service soon to be inaugurated by the company. As practically all of the subscribers desired the improved service, there was no objection to the proposed increase in rates.

A hearing, upon motion of the commission, was recently held on the matter of the service and facilities of the Neshonoc Light & Power Company. It developed at the hearing that there were just grounds for the numerous complaints which have been registered against the service rendered by the company. This inefficient service was shown to be due largely to the very poor condition of the plant and the apparent incompetent attendance which it has had. The management contemplates a complete renovation of the plant and a formal order by the commission is being withheld for the present.

The Kenosha Electric Railway Company has filed an application for a certificate of convenience and necessity for a franchise to engage in a general lighting business in the city of Kenosha, Wis.

Massachusetts Legislative News.

The Senate has killed the bill requiring street-railway companies to limit the work of their employes to 9 hours in 11 consecutive hours. The measure was substituted in the House for an adverse report by the committee on street railways. Senator Ross, of New Bedford, made an attempt to move a reconsideration, but was defeated. The committee on street railways has voted in favor of permitting the Boston Elevated Railway Company to purchase the stock of other street railways, but on account of the opposition of Representative Wolcott to the merger plan, it is uncertain as to the outcome of

the bill. The committees on railroads and street railways, sitting jointly, have voted to report the bill permitting the New York, New Haven & Hartford Railroad Company to purchase the Berkshire Street Railway. The bill to provide for the relocation of the westerly terminal of the Riverbank Subway in Boston has been passed to be engrossed by the House. The Senate has received a resolve providing that the railroads operating within the metropolitan district be directed to prosecute studies with reference to the electrification of their service in the district, and to submit the results of such studies to the joint commission on metropolitan improvements by Nov. 1, the latter to continue its investigation of the subject and to report to the Legislature of 1911 in January, with the draft of an act which shall provide for the electrification of the railroads within a stated time. The act is to empower the proper board or boards to determine the manner in which the work shall be prosecuted.

Maryland Public Utility Commission.

Mr. Emerson C. Harrington, of Cambridge, has declined the secretaryship of the Maryland Public Utilities Commission. When he was elected secretary about a week ago it was predicted that he would not accept the place as it only pays $3,000 a year. The public utilities bill passed the Legislature about six weeks ago and the commission was supposed to be in operation immediately, but as yet it has only one regular employe, namely, Mr. J. Clarence Bowerman, who has been appointed chief clerk and has entered on his duties. Mr. Bowerman was formerly the secretary of the State Roads Commission, and private secretary to Frank Brown when the latter was the Governor of Maryland, and later a court stenographer. The appointment is generally considered an excellent one. Mr. Robert R. Carmen is being prominently mentioned in connection for the appointment as assistant counsel of the commission. Mr. Carmen is a graduate of Western Maryland College and of the law school of the University of Virginia. He has been practising law in Baltimore City for several years as one of the firm of Osborn & Carmen, Mr. Osborn having served as a member of the last House of Delegates.

The commission has moved from the Union Trust Building to the Builders' Exchange Building, where Chairman Ambler and Commissioner Laird are busily engaged in studying the rules of procedure in the investigation of public-service corporations. The commission lacks the third member, who is in Asia and has not expressed his willingness to serve. Until the appointment of a chief counsel, the Attorney-General of the State will act in that capacity, along with his other duties.

Mr. Walter W. Abell, who about a month ago was appointed by the Governor a member of the Maryland Public Utilities Commission, has cabled from Yokohama, Japan that he will not accept the apointment. While awaiting Mr. Abell's decision Chairman Ambler and Mr. Laird, the other two members of the commission, have been conducting business as it came along. Judge Pearce, who was first appointed chairman of the commission, declined, and Mr. Emerson C. Harrington declined the appoinment of secretary to the commission.

Mr. Louis M. Duvall last week accepted appointment as secretary of the commission. The salary is $3,000 a year and it is understood that the Governor made the appointment after consulting the members of the commission. Mr. Duvall was for many years the business manager of the *Baltimore News*. His business career began as expert accountant with the Northern Central Railway. He next served in the Record Office as cashier for 10 years, and then went with the Maryland Title Insurance & Trust Company, of which he was secretary-treasurer for three years, which position he left to accept one with the *Baltimore News*. During his career he managed to find time to study law, and he has been engaged in the practice of his profession recently. Mr. Duvall has stated that the appointment is very agreeable to him, as the work would be along lines with which he was most familiar. He will suggest to the commission that he be sent to New York to study the methods of the commissions of that State.

The erection of pole lines, whether for telephone, telegraph, electric light or other service, is subject to the control of the commission, according to an opinion given Chairman Ambler last week by Attorney-General Straus. The question was brought up through a complaint by Joseph P. Sinnott, of Baltimore, who said that the Consolidated Electric Light & Power Company had utilized the pavement in front of his property. "While the commission undoubtedly has authority in such cases," said the Attorney-General, "its authority in this particular case depends upon the time that the pole was planted. If the company erected it after the commission was appointed it violated the law, for the commission must pass upon the necessity of planting poles and on their location. If the pole was erected before the commissioners went into office, which was May 1, they have no authority whatever. Poles that had been planted must be allowed to stand." The Attorney-General has been at work for the past few weeks on a voluminous opinion intended to cover every phase of the Public Utilities law. He has found a great deal of law on the subject, especially in the New York courts, where the law has been in operation for some years. These opinions help to develop the law by making plain its scope and its limitations. Some of them are quite recent.

Several other complaints were registered with the commission. One of these was from Frederick Wryght, of Irvington, who last week filed a complaint against the United Railways & Electric Company in connection with its method of handling cars at the Frederick Avenue terminus, and suggesting the extension of the switch beyond the city limits so that the company's patrons could alight at a point closer to home. He has asked for a public hearing for himself and neighbors. Another complaint was from William H. Grafflin, of Millersville, against the Electric Express Company, a subsidiary of the Washington, Baltimore & Annapolis Electric Railway. He states that the company refuses to haul strawberries to Odenton and make a connection with Adams Express Company. He says, however, that the company will take them to Washington, or bring them to Baltimore and make the transfer; but that, he says, is because the company gets the advantages of a longer haul. He also complains that the company charges $1 for a round-trip ticket from Waterbury to Baltimore, 10 miles less distance than Annapolis to Baltimore, for which the same fare is charged.

Massachusetts Commission News.

The Massachusetts Gas & Electric Light Commission has issued an order approving the issuance by the Hadley Lighting Company of 340 shares of new stock of the par value of $25 each. The proceeds of 260 shares are to be applied to the construction of distributing lines by which electricity purchased from the Amherst Gas Company is to be sold to the customers of the Hadley Company. The board has received a petition from the Salem Electric Lighting Company for approval of an issue of new stock of the par value of $250,000 for the payment of indebtedness incurred in enlargements and improvements of the property.

The board has approved an issue of stock by the Fall River Electric Light Company amounting to 2000 shares, at a price of $150 each. The proceeds are to be used for the payment of the cost of plant construction and extensions of the system. A hearing will be given on May 27 at Newburyport upon the petition of the municipal authorities for reductions in the rates of the Newburyport Gas & Electric Company.

New York Public Service Commission News.

The Public Service Commission of the First District has sent a letter to the Board of Estimate and Apportionment recommending the expenditure of $50,000 in changing the line of the

Fourth Avenue subway in Brooklyn by moving the entire tunnel 10 ft. to the west for the distance that it runs under Ashland Place before curving into Fourth Avenue. This change is recommended in order that the tunnel may not pass under the Brooklyn Academy of Music and also in order that Ashland Place may be widened. The commission at its meeting last week, however, by a vote of three to two refused to change the plans of this subway so as to abandon the Ashland Place route in favor of a line under Atlantic Avenue and a tunnel under the East River to the Battery.

Vice-President Ira A. Place, of the New York Central Railroad, has written a letter to the Public Service Commission transmitting a plan for connecting the Grand Central Station with the various subway systems that will eventually center at Forty-second Street and Fourth Avenue. According to this plan, there will be five levels, the lowest nearly 70 ft. below the surface of the street. The first level will be occupied by a joint subway concourse. The second level will be for the Broadway-Lexington Avenue local trains. The third level will be for the Hudson & Manhattan Railroad concourse, the fourth for the Broadway-Lexington Avenue express trains, and finally, the last level will be taken up by the Steinway tunnel and the New York & Long Island tracks. There will be elevators from Park Avenue on the one side and Lexington Avenue on the other. Mr. Place suggests that the new Lexington Avenue subway station be located at Forty-third Street instead of at Forty-second Street in order to carry out the plan for proper connection with the Grand Central Station. The commission referred the plan to its engineers.

The commission last week sent a letter to the Board of Estimate containing a report on pipe galleries for the new Broadway-Lexington Avenue subway. This report said that the commission did not believe construction of the subway should be indefinitely postponed or even delayed for four months as would probably be the case if an attempt was made to carry out the recommendations of the city engineers. The commission is of the opinion that the contract should be advertised without immediate provision for pipe galleries, or that the present plan should be followed with such modifications as may be found desirable when the shop drawings are being prepared.

The commission has been holding almost daily hearings upon the reorganization plan of the Third Avenue Railroad Company during the past week and rapid progress is being made in this direction. Mr. William D. Guthrie, chief counsel for the railroad company, has occupied the time at the hearings with the cross-examination of Mr. E. G. Connette, the transportation engineer of the commission.

The commission has ordered the various subsidiaries of the Brooklyn Rapid Transit Company to equip all closed cars hereafter acquired with full vestibules on each platform. This action was taken after hearings on a complaint from the State Congress of the Knights of Labor.

The Board of Estimate last week passed a resolution asking the Appellate Division of the Supreme Court for a determination of the amount of debt incurred prior to Jan. 1, 1910, for rapid transit purposes in order that these bonds may be excluded from the debt limit, in accordance with the law signed recently by Governor Hughes. Subsequently, similar action will be taken in connection with self-supporting dock bonds.

The Board of Estimate adopted a resolution last week calling upon the Edison Electric Illuminating Company, of Brooklyn, to furnish proof of its franchise rights to operate in the Thirtieth Ward of Brooklyn. These rights were derived from the Amsterdam Electric Light, Heat & Power Company, which the Edison company controls through stock ownership. The city engineer reporting upon the matter says that he fails to find that the Edison company is authorized to operate under the franchise claimed by the Amsterdam company. The investigation was brought about through the vigorous complaint of a citizen who objected to the erection of poles in front of his property.

The Public Service Commission, Second District has authorized the Hallett Light & Power Company to transfer all franchises, property and systems to the Riverhead Electric Light Company, and authorized the Riverhead company to acquire and hold such franchises, rights, properties and works. The Riverhead Electric Light Company is authorized to pay for the franchises, properties, etc., by recalling all of its capital stock now outstanding, amounting to $7,500, and issue new stock to the amount of $6,000, of which $3,000 par value shall be issued to the stockholders of the Riverhead Electric Light Company and the remaining $3,000 to the Hallett Light & Power Company, or such person as it may designate.

The Snyder Gas Company, of Erie County, has been authorized to exercise franchises in the town of Amherst and has approved of certain lease agreement for drilling and operating a gas well in that town. The company is also authorized to issue $5,000 in stock to carry out its operating plans.

CURRENT NEWS AND NOTES.

Comet Closed Lighting Plant.—The Mayor of Nashville, Tenn., ordered the electric street-lighting system to be shut down at 3:30 a. m. one day during the comet visitation so as to give the citizens an opportunity to see the comet.

Gift for Armour Institute.—Mr. J. Ogden Armour, just before his recent departure for Europe, made a gift of $70,000 to Armour Institute of Technology. The gift was kept secret until after his departure.

Fort Wayne Electrotechnic Club.—At the annual meeting of the Electro-technic Club of Ft. Wayne the following officers were elected: President, Mr. E. B. Hoff; vice-president, Mr. Oliver Cooper; secretary, Mr. Harry Balls; treasurer, Mr. L. G. Duryer. Mr. F. S. Hunting, manager of the Ft. Wayne Electric Works, during the meeting addressed the members of the club on "Co-operation."

Wireless Station Erected in 68 Seconds.—The signal corps at Fort Meyer, Va., has a portable wireless plant with a 40-ft. antenna which is capable of sending messages 25 miles, and it is claimed that the trained corps can unpack and erect the plant and be ready to operate inside of 1 minute and 8 seconds.

Telephones Under Public Service Commission.—The general amendment to the Public Service Commission law, extending the jurisdiction of the commission of the second district to telephone and telegraph companies, was passed in the Assembly at Albany. A similar amendment to give jurisdiction to the commission in the first district over telephone companies in New York City was defeated.

National Incorporation.—At the annual meeting last week in New York of the National Association of Manufacturers, the Committee on National Incorporation presented a report approving the design and plan of the National Incorporation act now before Congress as wise in object, sane in terms, beneficent in purpose, and would insure the lasting good of our political industrial body. The bill is stated to be a wise step forward in the direction of a just and desirable freedom of business development and national industrial prosperity.

Wireless Compulsory.—A favorable report has been rendered by the House judiciary committee on the Senate bill prohibiting, after July 1, 1911, any ocean-going steamer of the United States or any foreign country carrying more than 50 persons from attempting to leave any port in this country unless equipped with an adequate wireless apparatus, manned by a skilled operator and capable of sending wireless messages a distance of at least 100 miles. An exception is made in the case of steamers plying between ports less than 200 miles apart.

Wireless for Railroads.—In the storm districts of the Western railroads it is planned to use wireless to insure continuity of operation during all kinds of weather. The Union Pacific Railroad is at present installing a series of stations along the line through Kansas, Nebraska and Wyoming.

A. I. E. E. Sections and Branches.—On April 30 the American Institute of Electrical Engineers had 25 local sections and 31 branches. At the former 187 and at the latter 147 original papers were presented. During the year five papers presented before sections and branches were printed in the *Proceedings* in full and four in abstract.

A. I. E. E. Meeting.—A meeting of the American Institute of Electrical Engineers will be held in the auditorium of the Engineering Societies Building, New York, Friday evening, May 27, under the auspices of the railway committee. Papers will be presented by Mr. W. N. Smith on "Electric Railway Catenary Trolley Construction" and by Mr. W. H. Kempton on the "Application of Porcelain to Strain Insulators."

Selection of Coal.—Among the papers presented at the second annual meeting this week in Chicago of the International Railway Fuel Association is one by Prof. H. H. Stoek on the "Mechanical Preparation of Fuel," which subject is treated under the heads of sizing, washing, coking and briquetting. Some information of interest to all large users of coal is contained in a committee report on the selection of coal for locomotive use.

Northwest Electric Light Association Convention.—The Northwest Electric Light and Power Association will hold its annual convention on Board the steamer *Queen,* leaving Seattle in the evening, Aug. 26, and returning the morning of the 29th. The boat will stop at various Sound cities, where arrangements will be made to provide suitable entertainment for the visitors. An exhibition will be held on the deck. The program will include many interesting papers and a jolly time is anticipated.

A. I. E. E. Membership.—The total membership of the American Institute of Electrical Engineers on April 30, 1910, was 6681, an increase of 281 over the previous year. During the year 110 members resigned and 488 were dropped for nonpayment of dues. The number of full members was 641 and of associate members 6039. There is but one honorary member, Sir William Henry Priece. The annual report does not give the number of members in the student grade, to which 507 additions were during the year recommended by the board of examiners.

Edison on the Cheapening of Necessities.—Mr. Thomas A. Edison has turned his expert inventive attention to retail merchandizing and has proposed a scheme for lessening the cost of serving customers by application of the nickel-in-the-slot plan in stores catering to the poor man. He proposes to use the plan in connection with groceries and general domestic supplies that can be handled in boxes. The inventor's concrete house built as a whole by the "pouring" method is a feature of the "Ideal Home Show" now being held in New York, where it is exhibited in model form. It is claimed that such a house can be constructed at a cost not to exceed one-half of the former cost for a similar house built by the older methods.

A. I E. E. Elections.—At the annual meeting of the American Institute of Electrical Engineers, held in New York on May 17, the following officers were declared elected as a result of the regular leter ballot: President, Prof. D. C. Jackson; vice-presidents, Prof. Morgan Brooks and Messrs. H. W. Buck and P. H. Thomas; managers, Messrs. H. H. Barnes, R. G. Black, W. S. Rugg and C. E. Scribner; treasurer, Mr. Geo. A. Hamilton; secretary, Mr. Ralph W. Pope. The proposed amendment of the constitution, which was designed to place selection of the secretary in the hands of the board of directors, rather than to leave it to the vote of the membership, as at present, was not carried, on acount of the failure to obtain the requisite 75 per cent of the votes cast.

Specific Heat of Steam.—At a meeting of the Faraday Society held in London on April 26, Prof. W. Nernst communicated a paper on "The Specific Heat of Ice, Water and Steam." The author's survey covered the whole field from —200 deg. C. to the highest temperatures. At low temperatures the specific heat was calculated by means of the thermodynamical theorem established by the author, while the variation in the specific heat of steam under high pressure was fully accounted for. The values for water vapor were deduced from the kinetic theory. Attention was directed specially to the minima in the specific heat of water vapor under moderate pressures and of liquid water at moderate temperatures. Both minima were attributed to the dissociation of complex molecules.

Definition of Annual Horse-Power.—After considering further evidence submitted to him, Mr. Justice Riddell, of Toronto, has confirmed his decision and dismissed the action of the Attorney-General for Ontario against the Canadian Niagara Power Company. The action was brought under a contract between the company and the commissioners of Queen Victoria Niagara Falls Park to recover about $15,700 for water used in the generation of electric power at the company's power house at the Falls. The plaintiffs claimed that the power should be measured at stated times, the measurements so found to be the basis of payment. Mr. Justice Riddell held that the plaintiffs can only recover payment for the amount of energy actually used. An account of this interesting case was given in these columns in the issue of Nov. 11, 1909.

Labor Union Examinations.—The new plan has recently been adopted by the Electrical Workers' Union in Chicago for the examination of applicants to membership in the union. Heretofore it has been a common cause of reproach to union men that the only requirement for entrance to the union and for the high scale of wages demanded by union men is the payment of a high initiation fee. The Chicago union now proposes to examine applicants for admission. This examination, to judge from the apparatus and switchboard which has been prepared for this purpose, consists partly of a demonstration of the ability of the applicant actually to connect up correctly various pieces of apparatus to switchboard appliances provided. The necessary apparatus being provided, the applicant is required to make a proper connection and to put the machines in operation.

Chicago's Harbor Problem Discussed at Electric Club.—The speaker at the weekly luncheon of the Electric Club, Chicago, on May 18, was Major George H. Rees, U. S. A., chief engineer of the Department of the Lakes. His subject was "Relations of the Federal Government to Local Interests from an Engineering Point of View." The talk was confined principally to river and harbor improvements. For the War Department, Major Rees' office has supervision of Chicago Harbor and Calumet Harbor (South Chicago) in Illinois, and Indiana Harbor, Gary Harbor and Michigan City Harbor in Indiana. The navigation of the Chicago River, which is practically the Chicago Harbor, is hampered by the narrowness of the stream and its bends, as well as by 47 bridges. If Chicago is to retain even its diminished prestige in lake navigation, some method must be devised to mitigate the bridge obstructions. The speaker said that the policy of the United States in relation to harbor improvements is liberal and progressive, while that of Illinois and Chicago is obstructive and dilatory, due to existing laws. The Indiana laws, on the other hand, are favorable to the use of the lake front for harbors. The proposed lake front harbor was favored by Major Rees. Messrs. F. P. Vose and F. J. Postel took part in the discussion, which was brief.

HYDROELECTRIC DEVELOPMENT ON THE ILLINOIS RIVER.

Station of the Russellville Water & Light Company at Russellville, Ark.

RUSSELLVILLE, the seat of Pope County, in the northwest central part of Arkansas, is supplied with electricity from a modern hydroelectric generating station which develops a 24-ft. drop in the Illinois River, five miles distant. The region served by this plant is an important cotton-growing and agricultural section; valuable belts of timber are not far distant, and the whole country thereabouts is underlaid by a rich bed of coal approximating in burning qualities the characteristics of anthracite. Russellville is a thrifty and coming town of 3500 on the Arkansas Division of the Missouri Pacific Railroad about midway between Little Rock and Fort Smith.

The water-power has, in fact, "arrived" in advance of the town and surrounding country, which is now being rapidly educated to the uses and conveniences of electricity. The development of the region, however, is assured, and while the utilization of the water-power involved heavy investments in first costs, the future of this country promises good returns for the excellent use made of this money. The complete plans contemplate a water works for Russellville and an electric railway connecting Russellville with Dover, 10 miles north; besides the transmission of energy to surrounding towns and mines.

Five miles northwest of Russellville, the Illinois River, a tributary of the Arkansas, formerly underwent a series of water-

Dam and Power House, Russellville, Ark.

falls and rapids, averaging 8 ft. of drop to the mile. By throwing a dam across the river below this point a head of 24 ft. has been created, backing up the stream for about 4 miles, although on account of its steep banks flooding little adjacent land. The dam is a concrete monolith, 352 ft. long, 271 ft. of which is a spillway having its sill 24 ft. above the power-house outlet level and 29 ft. above the solid bedrock on which the whole structure of dam and power house rest. The base of the dam is 25 ft. wide, the section diminishing to a 5-ft. breadth on top of the spillway, and to 4 ft. at the elevated ends, which are 9 ft. above the sill of the latter. The concrete dam is in the form of an 11-deg. curve, and at one extremity is extended across the valley lowlands by an earthen dyke the height of the structure for protection against severe floods.

At the east end of the dam is the intake raceway, 190 ft. long between concrete walls, leading to the power-house entries. This raceway is 32 ft. wide and 8 ft. deep, and is protected by a trash-rack of 1-in. x 4-in. timbers spaced at 2-in. intervals. The floor of the power house is 30 ft. above the tail-water level, being mounted over the massive concrete masonry containing the water-wheel chambers. The power house itself is 32 ft. wide and 54 ft. long, and the generator-room is 16 ft. high. Along the west side of the room appear the vertical shafts of the four Davis water-wheels mounted in the submerged turbine pits below. These shafts drive, through bevel gearing, the main shaft which extends along the side of the room and through clutches and is provided with 48-in. pulleys driving through 20-in. belts on 22-ft. centers the 30-in. pulleys of two 150-kw, 6600-volt, 60-cycle, three-phase General Electric alternators at 600 r.p.m. Each alternator shaft is also belt-connected to a 5-kw, 125-volt direct-current exciter. The water-wheel and generator speeds are automatically regulated with nicety by a Woodward governor mechanism, belted to the main shaft. The present water-wheel capacity is 680 hp, and when necessary additional generators will be added on the floor between the present machines. Through two generator panels equipped with the usual ammeters, voltmeters, wattmeters, circuit-breakers, field rheostats and lighting arresters, the 6600-volt output of the alternators is taken directly to the transmission line leading to Russellville, 5 miles distant. This single circuit is made up of three No. 6 bare copper wires on 22,000-volt insulators, carried on 30-ft. poles set at 100 ft. intervals. Although the present transmission voltage is 6600, later, energy from this plant may be sent to several towns at distances of 25 miles or more so that the higher potential was provided for.

The Russellville Water & Light Company, which has carried out and is operating this electrical development, is also preparing to supply water to the town. In a pump-house adjacent to the generating station there will be installed two 30-hp motor-driven centrifugal pumps. These pumps will take water from the raceway, lifting it 150 ft. to a concrete-walled reservoir, 86 ft. x 87 ft., and 12 ft. deep, on the top of the mountain behind the generating station. This reservoir is 168 ft. above the city and will contain about 700,000 gal.

In excavating this reservoir, the solid rock was blasted out and delivered by chutes to a crusher half-way down the mountain slope, from which the crushed material was then again chuted to the concrete mixer on the dam site. In this way both material and haulage charges were largely saved, and a single handling of the rock served a double purpose. The fine debris obtained from crushing produced sufficient sand for the concrete mixture.

The Illinois River, which the water-power utilizes, drains 330 sq. miles of a territory including the southern foothills of the Ozark Mountains, which have an average annual rainfall of 46 in. The river flow is quite uniform. A large amount of the water is spilled at all times of the year, as the present demand utilizes only a fraction of the available water-power.

At Russellville the 6600-volt transmitted energy is reduced to 2200 volts for local distribution to transformers for lamps and motor circuits. The present 200 lighting customers in Russellville consume nearly 9000 kw-hours per month, with a maximum demand of about 100 kw. The rates for energy are 20 cents per kw-hour for the first 20 kw-hours and 10 cents per kw-hour thereafter. A 5 per cent discount is allowed for payment of bills before the sixth of the month. Three multiple street arcs and 38 incandescent street lamps are also supplied by the company in Russellville.

Beyond Russellville the 2200-volt line has been extended several miles to a coal mine, where at present a 15-hp motor driving a ventilating fan is in operation. Later a 75-hp pump motor will be installed and the entire mine operation probably rendered electrically, replacing the present 200-hp steam equipment. An excellent variety of coal, approaching anthracite in quality, is found 460 ft. below the surface at this point and throughout this vicinity. The advent of cheap energy will probably open up other mines, as the life of boilers with the water now available is a matter of only a year or two. A number of cotton gins are also in this vicinity, but as the operation of these plants involves a 24-hour load only three months in the year at a time coincident with possible low water the electric company does not look upon such connections as especially valuable. At the present time the company is operating about 70 motors in Russellville

ranging from 1 hp to 15 hp in the various shops, planing mills, printing offices, machine shops, furniture factory, etc., of the town.

Later it is hoped to transmit energy from Russellville to Dardanelle, Atkins, Morrilton and Clarkesville, towns 8, 15, 29 and 30 miles distant, and with populations of 3000, 2000, 3500 and 2500, respectively. The first-named town is now operating a 60-kw municipal plant, which has been a losing venture, and to put this business on a stable basis it is probable that the Russellville line will be extended.

On the present transmission line, near Russellville, the new Arkansas Agricultural School is being erected. About 60 hp in motors has already been contracted for in these buildings to drive the various dairy and farm appliances of which use is made. So far as possible all the class of apparatus here will be motor-driven in order to demonstrate the possibilities of electricity. The reflection of this instruction will be felt among the present and future farmer classes. No provision has yet been made for supplying energy to farms from the transmission line, as the region it traverses is sparsely populated, but it is believed that requests for this service will come later.

Following the completion of the water works, work will be started on the electric railway to be built from Russellville to Dover, and passing within a quarter mile of the power house, etc. The transmission line now erected stands on one side of part of the 100-ft. railway right-of-way now surveyed through to Dover. This electric railway will haul freight as well as passengers, as it will penetrate into a country where the next railroad is 65 miles distant. At present Dover has no railroad connection.

The work thus far accomplished on the hydroelectric development and water works of the Russellville Water & Light Company has involved an expenditure of about $100,000. The officers of the company are: President, Mr. A. Brewster; vice-president, Mr. C. S. Bacon, and secretary, Mr. Garland Brewster. Mr. E. C. Buchanon, of Little Rock, Ark., designed the plant. Mr. W. H. Guest is operating engineer, and Mr. E. Stovekin is superintendent at Russellville.

THE DANVILLE CENTRAL STATION SYSTEM.

Distribution of Energy from Substations and Transformers Along the Transmission Line.

A RECENTLY built central station which supplies electricity for a number of towns in its county and for farmers along the lines is that of the Danville Light, Heat & Power Company, of Danville, Ind. This company, with its power house at Danville, supplies electric light and power service to Danville, Plainfield, Avon and Brownsburg.

HISTORY OF THE ENTERPRISE.

The present owners took over the electric lighting plant at Danville, Ind., in 1906. The equipment consisted of a 60-kw, 133-cycle, 1100-volt, single-phase alternator driven by an Atlas slide-valve engine; a 35-lamp Thomson-Houston, 10-amp arc dynamo driven by a Straight-Line high-speed engine, and two horizontal return-flue boilers. The plant was not on a railroad and all coal had to be hauled by wagon.

The plant at Plainfield, which was purchased by the Danville company in 1908, had a 60-kw, 60-cycle, single-phase alternator driven by an Atlas four-valve, 12-in. x 18-in. engine. There were 18 6.6-amp series arcs at this time.

The Danville Light, Heat & Power Company, which is the present corporation, bought the Danville plant in December, 1906. Some changes were made in the old plant. The roof had to be rebuilt, new foundations were put under the machinery and a concrete floor was laid. A new 120-kw, 133-cycle alternator was added and an addition was put on the building. The lines in the town were partially rebuilt. At the time the company bought the plant, in December, 1906, the gross earnings for the previous year had been $8,000, of which $2,500 was net above operating expenses. Night service only was given. The company operated this old plant one year and brought the gross yearly earnings up to $12,000. About 60 of the 185 consumers were on meters when the plant was bought. All consumers were metered by the new company, which fact had much to do with the increased earnings. For the year ending January, 1908, the net earnings over and above maintenance were $3,012.25.

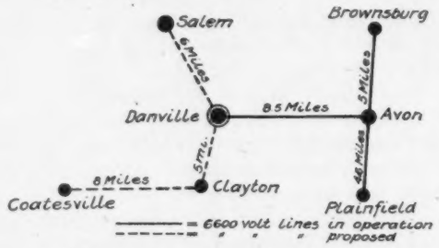


Fig. 1—Map of Transmission System.

In the summer of 1908 the Plainfield plant was purchased, and for a time was operated independently. In October, 1908, a new power-plant building was started at Danville, which is the nucleus of the new system. This plant began operation in May, 1909. It is a 60-cycle, single-phase plant, and along with the change to 60 cycles the distribution system was thoroughly overhauled. Poles were renewed and 18 large transformers replaced 58 old small transformers.

TRANSMISSION SYSTEM.

Fig. 1 is a map showing the transmission lines of the company, present and proposed. From Danville, where the power house is located, a single-phase transmission line runs east, just outside of the right-of-way of the interurban line of the Terre Haute, Indianapolis & Eastern Traction Company, to Avon. From Avon one branch runs south to Plainfield and another line north to Brownsburg. From Danville to Avon is 8.5 miles; from Avon to Brownsburg, 5 miles, and from Avon to Plainfield, 4.5 miles, making a total of 18 miles of single-phase transmission. The approximate population of the towns served is as follows:

Danville	3200
Plainfield	1800
Avon	200
Brownsburg	1300
Total	6500

The transmission line has poles spaced 105 ft., center to center. Most of the poles are 30 ft. long with 6-in. tops, longer poles being used at crossings with other lines and wherever necessary to preserve good alignment. The cross-arms are 5 ft. long equipped with four pins. The insulators are brown porcelain. The conductors are No. 4 B. & S. gage copper wire. The ground wire is of 21,900 circ. mil soft-iron wire. Galvanized-steel gains are used to fasten all cross-arms to the poles and in addition galvanized-steel cross-arm braces are used. For lightning protection an overhead ground wire of galvanized iron is stapled to the top of the pole.

The transmission system is supplied with energy through three step-up transformers in the power house at Danville. Each of these is of 50-kw rating, with 2200-volt primary and 6600-volt secondary.

At the Plainfield substation, which was formerly a power station, there are two 35-kw step-down transformers reducing the e.m.f. from 6600 volts to 2200 volts. At the Brownsburg substation there are two 25-kw transformers of similar voltage. The total rating of the transformers in these substations is 120 kw.

A number of small transformers are located at various points along the transmission line; in fact, this is one of the interesting features of this distribution. Although there has been some

thought on the subject of providing service to farmers along the transmission lines of this kind, it has not been actually carried out in many cases. The total number of transformers located along the lines outside of the substations is eight; they range in size from 2.5 kw to 7.5 kw and supply energy to 18 consumers. Three-wire secondary circuits are run at 220 volts and 110 volts.

The monthly revenue for February, 1910, from these 18 consumers along the transmission line was $84. In serving these consumers the same rates are given as prevail in the towns which are supplied with energy by the company, but the consumer pays the cost of the step-down transformers and secondary circuits, and also the cost of any 6600-volt branch circuits which may be necessary. Besides the transformers supplying energy to the farmers, which have already been spoken of there is a branch of 1.5 miles, which is run to a tuberculosis sanitarium, where a 5-kw step-down transformer is installed.

Fig. 2—Danville Power Station.

The neutral of all the secondary circuits, both along the transmission lines and in the cities, is grounded by a connection to a galvanized-iron pipe, 10 ft. long, driven in the ground.

The company holds deeds to a strip of land 10 ft. wide the entire length of its transmission line. The consideration for this right-of-way was $1 in some cases and more in others, but the whole cost was nominal, as the company allowed the land to be used for farming purposes and retained only the right to maintain its pole line. The possibility of being able to get electric service from this transmission line, of course, was a strong argument with the farmers in securing the right-of-way.

DANVILLE POWER PLANT.

The new power plant at Danville has a total rating of 420 kw, all in single-phase, 60-cycle, 2200-volt generators. It is located on the Big Four Railroad and has good coaling facilities. Coal is unloaded directly from the railroad siding into a coal storage, which is directly in front of the boilers.

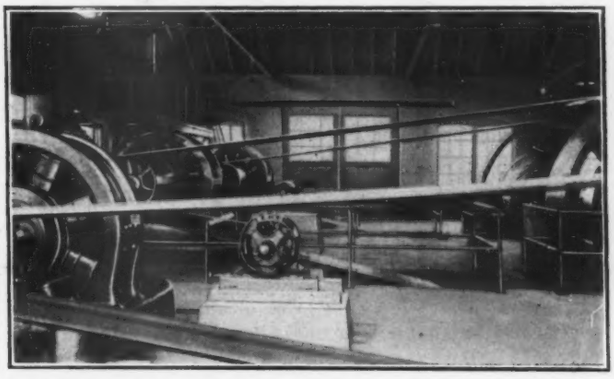


Fig. 3—View of Generating Room.

Fig. 2 shows the power station, the site of which is on sloping ground. The boiler-room floor is considerably lower than the rest of the building, and some excavation had to be made to make a level space for the engine-room portion, which is in the foreground in Fig. 2. A ground plan, giving dimensions of this power plant, is shown in Fig. 4. It is about 114 ft. long by 50 ft. wide. The cost of this building was about $8,000, or $190 per kilowatt of station rating.

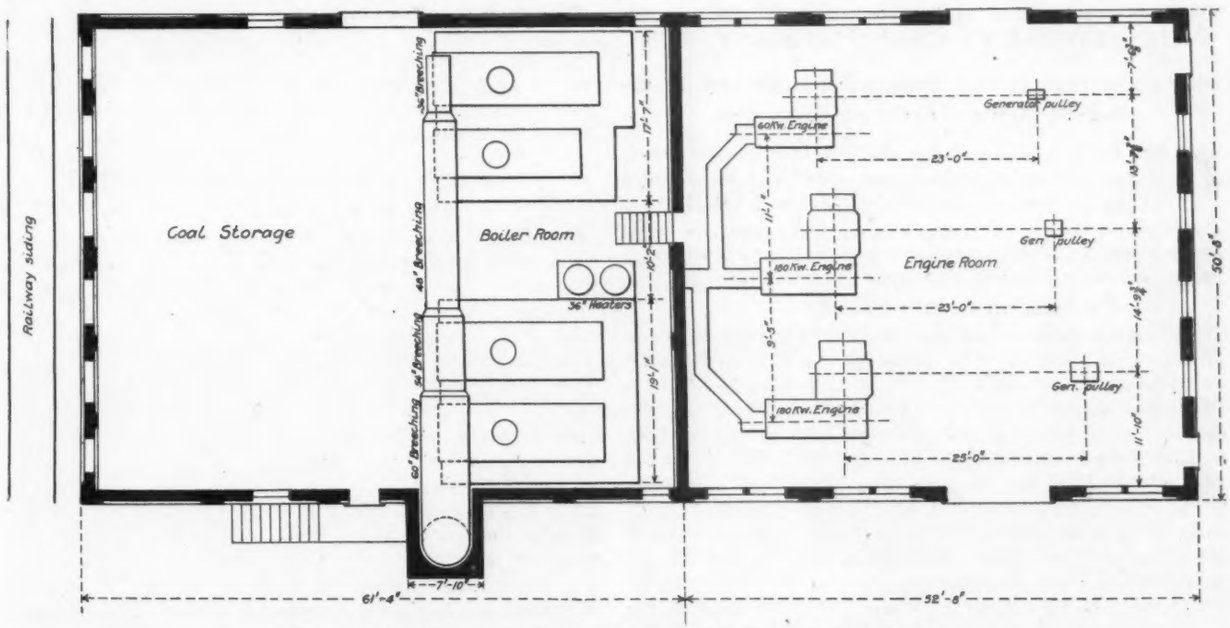


Fig. 4—Plan of Power Plant, Danville Light, Heat & Power Company.

The boiler equipment consists of four horizontal return-tubular boilers, two 125 hp, one 75 hp and one 90 hp, all of

which are allowed 125 lb. per square inch working pressure by the Hartford Steam Boiler Insurance & Inspection Company.

Coal is unloaded from railroad cars directly into a large space in front of the boilers. This space for coal will hold 200 tons. Feed water is secured from a well 185 ft. deep and 6 in. in diameter. The water is pumped from the deep well to an elevated storage tank from which it runs by gravity to the feed-water pump. The static head is such that the boilers can be filled by gravity when starting.

The engine equipment consists of three four-valve Atlas engines; one 12 in. x 18 in., running at 95 r.p.m. and rated at 105 hp, and two 19 in. x 24., 95 r.p.m., rated at from 225 hp to 250 hp. The two larger engines are new. The smaller engine was taken from the Plainfield power plant. The two larger engines are each belted to a 180-kw, single-phase, 2200-volt General Electric 60-cycle alternator, and the smaller to a 60-kw alternator.

The stack is of No. 8 steel, 5 ft. inside diameter and 111 ft. high.

The switchboard contains three generator panels, one local street-lighting panel, one feeder panel for the two local Danville feeders, and two transmission-line panels, one of which is empty to provide for any future transmission lines that may be built. As seen by the map, Fig. 1, there are some further possibilities in the way of transmission lines, one to Salem, northwest, and the other to Clayton and Coatesville, south of Danville.

The three step-up 2200-volt to 6600-volt transformers of 50-kw capacity are located on the gallery in the background in Fig. 3. The high-tension switchboard and arresters for the 6600-volt line are also located on this gallery. Besides the arresters located in the station, the transmisison line is protected by Garton-Daniels arresters placed three to the mile. These arresters are placed two in series for the safe handling of 6600 volts. A 35-lamp Westinghouse constant-current transformer is used to supply energy to the street-lighting circuits in Danville.

OPERATING FEATURES.

The operating force of the company now consists of one manager, two engineers, two firemen, three linemen and two office girls, who do bookkeeping and collecting. Of the linemen, the one located at Danville controls the transmission line and takes care of trouble among consumer's circuits along the transmission line from Danville to Avon; another, located at Brownsburg, takes care of local trouble in Brownsburg and controls the transmission line to Avon, and the third, located at Plainfield, takes care of troubles at Plainfield and looks after the transmission line as far as Avon.

A contract and supply department, which carries on a business of wiring houses in the various towns where the company gives service, is operated independently by the company. This department employs four men who are exclusively in the work of this department and the company looks to the foreman to conduct the business at a profit.

In Brownsburg and Plainfield collections are made by a collector, who does other work in the town at a rate of 2 cents per consumer.

The daily consumption of coal during the winter of 1910 was about 7 tons in 24 hours. An interesting fact in this connection is that the coal consumption of the new plant, with all the additional connected load, is now less than it was in the old plant for carrying the Danville lighting load nights only.

In Fig. 5 is shown the daily load curve of the plant taken March 25, 1910. As this was during a moonlight season, the street lighting in the various towns is not included in the load. This would add about 35 kw. There are also some large motors on the system, which were not operating on that day.

CONNECTED LOAD.

In February, 1910, there were 394 meters connected in Danville, 214 in Plainfield, 48 in Brownsburg and 18 on the consumers' services along the transmission line, making a total of 674. There were 33 6.6-amp series street arcs in Danville, and at present writing there are 37 with 10 more under contract. These are operated on a 1 o'clock moonlight schedule at $60 per year. In Plainfield there are 26 similar street arc lamps with three more ordered. In Brownsburg there are 3 multiple arcs and 24 132-watt Nernst lamps operating on 220-volt multiple circuit. The rate for the latter is $25 per year.

The record of miscellaneous heating appliances, etc., on March 4, 1910, was as follows: In Danville 115 electric irons, 24 fans, 12 motors aggregating 26 hp, and 4 vacuum cleaners. In Plainfield there were 35 irons, 12 fans and 9 motors aggregating 61 hp, the largest motor being 35 hp. In Brownsburg there were 6 irons, 7 fans and 6 motors aggregating 9 hp. On the transmission line at present there are only two motors, aggregating 2.5 hp.

New business contracted for and promised in March, 1910,

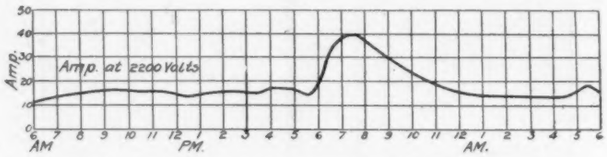


Fig. 5—Danville Load Curve, March 25-26, 1910.

included the following: Three 15-hp motors for the city pumping at Danville, a flour mill with one 30-hp and one 10-hp motor at Danville, a planing mill with a 5-hp motor, and a printing office with a 3.5-hp motor at Danville; at Plainfield a school and refrigerating plant calling for 5 hp; at Brownsburg a flour mill with 40 hp in motors and 50 residences; along the transmission line 16 customers, aggregating 20 hp in motors, besides electric light.

The rate for energy used in motors is 8 cents per kw-hour for amounts up to 300 kw-hours per month. For additional amounts discounts are given, and all energy used over 400 kw-hours per month is billed at 4.5 cents per kw-hour. The commercial lighting rate is 12.5 cents up to 20 kw-hours per month, with discount on amounts over this, and amounts over 150 kw-hours are billed at 7 cents. The residence lighting rate is uniformly 12.5 cents for all energy used. A meter rent of 25 cents is charged.

The company has a franchise in Danville for 25 years from 1908, in Plainfield for 25 years from 1906, and in Brownsburg for 25 years from 1909. Its transmission line rights through the country are perpetual. The street-lighting contracts mentioned are for 10 years.

TABLE I.—GROSS EARNINGS FOR ONE MONTH.

Danville	$1,096.95
Plainfield	680.23
Brownsburg	128.08
Transmission line customers	84.00
Total	$1,989.26

TABLE II.—OPERATING EXPENSES FOR ONE MONTH.

Coal	$311.00
Oil, carbon and waste	19.20
Rent	25.00
Insurance	35.00
Taxes	30.00
Office Expenses	25.30
Maintenance	56.80
Salary Accounts	480.00
General Expense	49.00
Total	$1,031.30

The development of this interesting little company has been carried on by its president, Mr. Gordon E. Varney, president of the Varney Electrical Supply Company, of Indianapolis; Mr. J. F. Lynch, secretary-treasurer and manager, has been in active charge of the developments at Danville and in the other towns supplied. The vice-president of the company is Mr. George E. Hume.

THE SINGLE-PHASE COMMUTATOR GENERATOR.—I.

Characteristics of the Asynchronous, Single-Phase, Shunt, Induction Generator with Mixed Excitation.

BY VAL. A. FYNN.

CONSIDER a stator carrying a two-pole winding S, as shown in Fig. 1, together with a rotor adapted to revolve within the stator and provided with a two-pole commuted winding C, the winding C being short-circuited along an axis approximately coinciding with that of S; for instance, by means of a pair of working brushes a-a. On the winding C there is impressed an alternating e.m.f. e along an axis displaced from that of S by approximately 90 deg. The rotor being driven at any desired speed, there will be obtained a single-phase generator capable of delivering a nearly constant e.m.f. E_2 to a consumption circuit AB, to which may be connected any sort of translating devices, such as L.

The periodicity of the actual working e.m.f. E_2 is quite independent of the speed at which the rotor is driven and depends only on the periodicity of e; this generator is, therefore, an asynchronous one. The primary working e.m.f. is generated in C at the brushes a-a by rotation in an exciting flux, as in any other generator, and is inductively transferred along the working axis a-a from C to S, where it appears as the secondary or actual working e.m.f. E_2; this machine is, therefore, an induction generator. The magnitude of E_2 depends on that of e and on the speed. The machine is, therefore, a constant-voltage or "shunt" generator. The exciting flux Φ_1 appears along the exciting axis f-f. Φ_1 is partly due to the e.m.f. e derived from any desired source independent of AB, for instance, by way of the transformer T, and is partly due to an e.m.f. er_2 generated

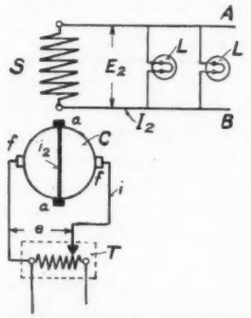


Fig. 1—Asynchronous, Single-phase Shunt, Induction Generator with Mixed Excitation.

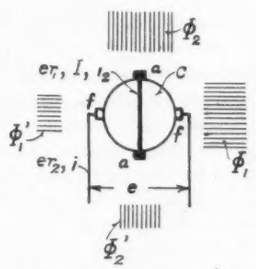


Fig. 2—Space Location of the Principal Vectors Appearing in the Accompanying Time-phase Diagrams.

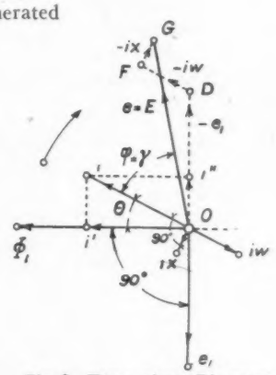


Fig. 3—Time-phase Diagram for the Generator shown in Fig. 1 at Zero Speed.

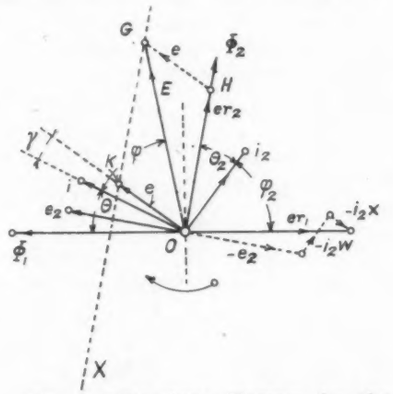


Fig. 4—Time-phase Diagram for the Generator shown in Fig. 1 at 120 per cent of Synchronous Speed.

in C by rotation. For this reason the machine is referred to as one provided with mixed excitation. The term "mixed excitation" implies that the machine is partly self-excited er_2 and partly separately excited e.

A close study of the generator shown in Fig. 1 is very instructive from many points of view and is necessary for the clear understanding of the more complicated, asynchronous, *self-excited*, single-phase shunt induction-generator, which will be dealt with in a subsequent issue.

In order to fix ideas let the resistance of C, including one set of brushes, either a-a or f-f, be w, and let the local rotor reactance along any axis be x. Imagine the brushes to be resting directly on the commuted winding and disregard the effect of those coils of C which are short-circuited under each of the brushes. These assumptions obviate the necessity of referring to the commutator connections and bring the axis of a flux produced by any current passing any set of brushes into coincidence with the axis of that set of brushes. Neglecting the short-circuits under the brushes does not materially vitiate the results if the machine is at all well designed.

Let the rotor be at rest within the stator and disregard the stator winding S for the moment. If an e.m.f. e be now applied to the brushes f-f, as shown in Fig. 2, then a current i will flow through C and will set up a flux Φ_1 along the exciting axis. Along this axis the commuted winding behaves just like the primary of a transformer on open circuit and the conditions at that moment are faithfully represented in the time-phase diagram shown in Fig. 3. The current i has a magnetizing component i' representing the recoverable energy, and a watt component i'' representing the irrecoverable energy. This current causes an ohmic drop iw and a reactive drop ix, the flux Φ_1 further induces in C an e.m.f. e_1. If i is to be maintained then e must equal and oppose the vectorial sum of $\overline{e_1 + iw + ix}$. The current i is seen to lag by a long time-angle ϕ behind the *total exciting e.m.f.* E impressed on the rotor along f-f. At zero speed this total e.m.f. E is just equal to the e.m.f. e derived from the outside source; the machine is, however, not a generator so long as the speed is nil. No current will flow through the short-circuit a-a because the working brushes connect points of C which are at equal potential.

If the rotor is set in motion and revolved at an ever-increasing speed, it will be observed that the current i taken by the rotor increases rapidly, although e is kept constant. Select any speed—say, 120 per cent of the synchronous, and reduce the magnitude of e until i comes back to its original value. The time-phase diagram for this new condition can at once be constructed. If i has the same value as before, then Φ_1 and E will surely have the same values and the same time-phase relation as in Fig. 3. These three vectors are accordingly represented in Fig. 4 and form the basis of that phase diagram.

By revolution of the rotor conductors in Φ_1 an e.m.f. er_1 is generated at the brushes a-a, sending a current i_2 through the commuted winding C along the working axis a-a. The commuted winding of Fig. 2 must behave like the primary of a transformer on open-circuit along a-a, as well as along f-f; the relative time-phase and value of i_2, as well as the phase and value of the flux Φ_2, which is due to that current can therefore be ascertained in a manner identical with that already explained for e, i and Φ_1 in connection with Fig. 3, as soon as er_1 is known. Now the value of er_1 can be very easily calculated according to first principles and its time-phase will be either the same as that of Φ_1 or opposed to the time-phase of that flux according to the direction of rotation of the rotor. Let that rotation be such that er_1 is of opposite phase to Φ_1 when i_2 and Φ_2 can at once be shown in Fig. 4, in the manner indicated. The time-phase differences ϕ_2 between er_1 and i_2 and θ_2 between i_2 and Φ_2 must be identical with the corresponding time-phase differences ϕ and θ of Fig. 3. But as soon as Φ_2 appears along the working axis a second e.m.f., over and above e, is impressed on the brushes f-f. This second e.m.f. er_2 is generated in C by rotation of this commuted winding in Φ_2 and appears at the brushes f-f. Its magnitude is as easily determined as that of er_1 and its time-phase is the same as that of Φ_2. Its direction depends on the direction of rotation of the rotor. If the direction of rotation is such that er_1 is of opposite direction to Φ_1 then the direction of er_2 will be the same as that of Φ_2, and vice versa.

The magnitude of er_2 obviously varies as the square of the speed for er_2 varies proportionately to the speed and to Φ_2 while Φ_2 is proportional to er_1, and, therefore, itself varies proportionately to the speed. Fig. 4 shows the magnitude to which e must be reduced if the magnitude of Φ_1 is to be the same at zero speed and at 120 per cent. of the synchronous speed. Indeed, if Φ_1 is to remain constant then the total e.m.f. E impressed on the rotor along f-f must remain constant. At zero speed the whole of E had necessarily to be supplied from *outside* and E was consequently equal to e. It has been shown that at 120 per cent of the synchronous speed an e.m.f. er_2 *generated on the rotor itself appears* at the brushes f-f; it is, therefore, clear that the outside e.m.f. e must now be equal to HG of Fig. 4 if E is to remain constant. The vector OK of Fig. 4, which is equal to and parallel with HG, therefore not only shows the magnitude of e, but also the phase relation which all the other vectors bear to this outside e.m.f., the time-phase of which, of course, remains constant. *Under speed the total exciting e.m.f. of E is made up of two components.* One of these is er_2, which is generated in the machine itself, and the other is e, which is derived from an outside and independent source. It has been shown that er_2 varies with the square of the speed. If that speed be varied, then the magnitude of e and its phase relation to the other vectors will also vary.

The point K, of Fig. 4, will travel along the line X. At zero speed K coincides with G and the time-phase difference γ between e and i will be identical with the time-phase difference ϕ between the exciting e.m.f. E and the exciting current i, as shown in Fig. 3. With increasing speed the point K will recede from G, ϕ will remain constant, but γ will diminish. At 120 per cent of the synchronous speed γ has the value shown in Fig. 4, and if the speed be further increased then γ must become zero and then positive. At the same time the magnitude of e first diminishes, passes through a minimum and then increases. All this is more clearly indicated in Fig. 5, where only the essential vectors of Fig. 4 are shown for four different

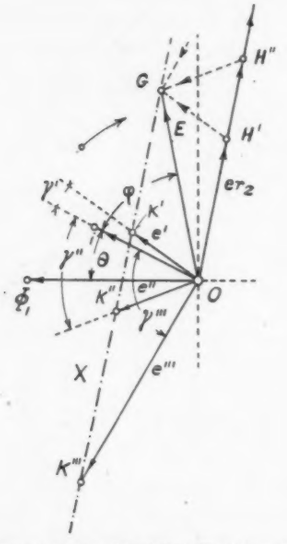


Fig. 5—Locus of Point K for Constant Exciting Flux and Varying Speed.

speeds. Point K' corresponds to 120 deg. of the synchronous, GK' is the corresponding value of er_2, while e' shows the necessary magnitude of e at that speed in order to keep Φ_1 constant and γ' indicates the corresponding time-phase displacement between the e.m.f. derived from the outside and the exciting current. Point K'' and the correspondingly marked vectors and angles show the conditions obtaining at 150 per cent of the synchronous speed. Point K''' corresponds to 200 per cent of the synchronous speed.

The phase angle ϕ is constant throughout all changes in speed; *the rotor impedance, therefore, remains absolutely constant at all speeds,* and is always equal to the zero speed impedance. *The time-phase angle γ between one component e of the exciting e.m.f. and the exciting current varies with the speed.* This fact has, however, nothing to do with the rotor impedance. The *apparent* impedance or the *apparent* power-factor of the exciting circuit is directly related to the time-phase angle γ. It may be noted from Fig. 5 that for the constants chosen e has not reached its minimum value when γ is zero and only does so after γ has become positive. Whether e reaches its minimum before γ has become zero, or later, mainly depends on the value of θ. The smaller is the value of w the sooner after synchronism has been reached will γ become zero. In an ideal machine, where w, x and θ are zero, the flux Φ_2 is always in time-phase-quadrature with Φ_1 and becomes equal to Φ_1 at synchronism. The locus for the point K, of Fig. 5, is a straight

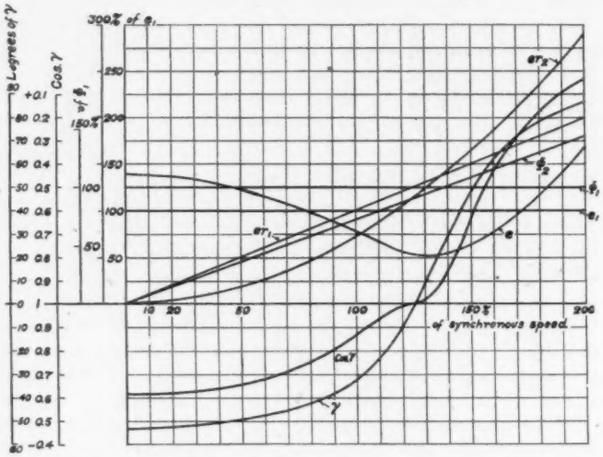


Fig. 6—Open Circuit Performance Curves of Generator Shown in Fig. 1 for Constant Exciting Flux and Varying Speed.

line at right angles to Φ_1, and passing through the origin. In an ideal machine e actually becomes zero at synchronism if Φ_1 is kept constant while the speed is varied and the time-phase difference γ is always equal to ϕ and always amounts to 90 deg.

The variation of the principal e.m.fs., fluxes and of γ and cos γ are shown in the form of curves in Fig. 6, having been derived from the diagrams in Figs. 3, 4 and 5. These curves will, of course, alter somewhat as the constants of the machine are altered, but their general character will remain the same. Some of these curves can be checked experimentally, and it is believed that such a test should prove highly instructive to students. Thus, the e.m.f. E_2 measured at the terminals of S must be a measure of Φ_2 and of e_2. If a similar winding S' be disposed on the stator at right angles to S, then the e,m,f, at the terminal of S' must be a measure for Φ_1 and for e_1. The currents i, i_2 and the e.m.f. e are, of course, readily measured as well as their phase relation to any other vector. γ can be obtained by a wattmeter measurement in the exciting circuit. If the short-circuit a-a be broken, then the relation between Φ_1, er_1 and the speed can be ascertained. It is not possible to measure er_2.

The conditions illustrated by Fig. 4 obtain under speed for Fig. 1, as well as for Fig. 2. It has been conclusively shown that *E is the exciting e.m.f.* responsible for the exciting flux Φ_1. It now becomes apparent that er_1, which appears at the brushes a-a, is *the primary working e.m.f.;* it is er_1 which is responsible for the flux Φ_2. Now Φ_2 is nothing but the flux of mutual induction of a transformer having a rotatable primary C and a stationary secondary S. The e.m.f. impressed on the primary happens in this case to be generated in that winding itself, by the revolution of the winding in Φ_1. This e.m.f. is always impressed on the primary coaxially with its secondary, because the brushes a-a are stationary in space. But the flux Φ_2 due to er_1 induces in C along a-a a back e.m.f., shown at e_2 in Fig. 4, and

must evidently induce an exactly proportional and co-phasal e.m.f. E_2 in the secondary S. Thus i_2 is nothing but the no-load current of the *static transformer C-S from the secondary of which is derived the energy dissipated in the consumption circuit AB*. It is, therefore, correct to designate E_2 as the *secondary working e.m.f.*

Having gained an insight into the general nature of the main phenomena governing the operation of such machines, some attention can be given to a very important secondary reaction.

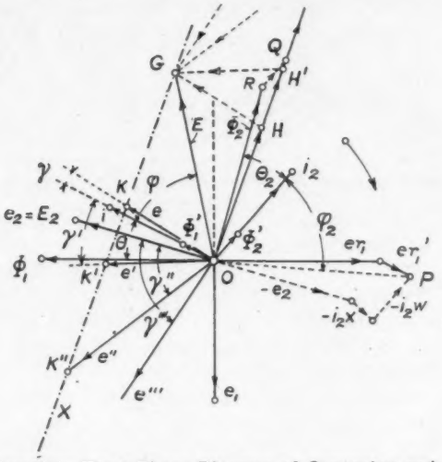


Fig. 7—Complete Time-Phase Diagram of Generator and Locus of Point K for Constant Exciting Flux and Varying Speed.

Figs. 4, 5 and 6 take account of only the *static* effect of the leakage fluxes in the rotor; the *dynamic* effect of the fluxes is strikingly illustrated in Figs. 7 and 8, especially if the latter be compared with Figs. 5 and 6. The leakage flux Φ_1' along *f-f* is coaxial, although not cophasal, with Φ_1 and is not only responsible for the *induced* e.m.f. *ix* in that axis, but also for the *generated* e.m.f. er_1' in the axis *a-a*, as shown in Fig. 7. Since er_1 is opposite in time-phase to Φ_1, then er_1' must be of opposite phase to Φ_1'. The actual e.m.f. responsible for Φ_2 is, therefore, not er_1, but $OP = \overline{er_1 + er_1'}$. Similarly Φ_2', the leakage flux along *a-a*, is coaxial, although not necessarily cophasal with Φ_2, and is not only responsible for the *induced* e.m.f. i_2x, but also for a *generated* e.m.f. which must be co-phasal

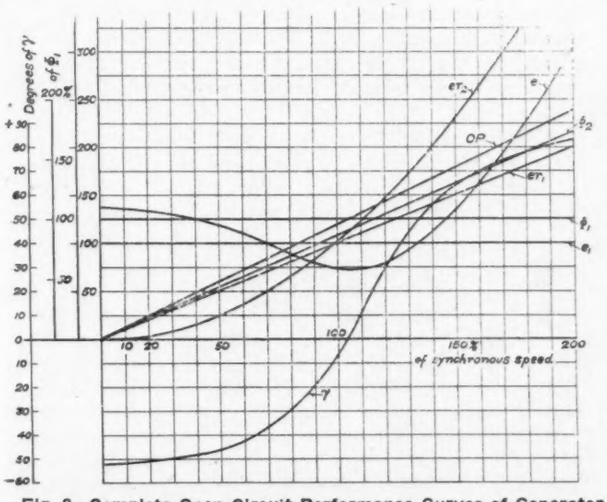


Fig. 8—Complete Open Circuit Performance Curves of Generator with Mixed Excitation for Constant Exciting Flux but Varying Speed.

with Φ_2' since er_2 of Fig. 4 is co-phasal with Φ_2. The actual er_2 is consequently not co-phasal with *OR*, but with *OQ* of Fig. 7, which is the vectorial sum of Φ_2 and of Φ_2'. While er_2 is proportional to *OQ* and the speed, yet e_2 and E_2 remain proportional to *OR*, or Φ_2 only, as in the incomplete diagram shown in Fig. 4. It is seen from Fig. 7 that this secondary phenomenon materially reduces γ at synchronism and causes the conditions to more nearly approach those which would exist in an ideal machine. These speed e.m.fs. due to the leakage fluxes do not, however, bring Φ_2 and Φ_1 more nearly into time-quadrature relation. This can only be achieved by increasing the power component of i_2. Figs. 7 and 8 represent the true conditions in such generators. The cos γ curve has not been plotted in Fig. 8 because the γ curve is just as instructive, and its intersection with the zero line is much more sharply defined. Fig. 7 shows that at standstill the energy ei cos γ is equal to the iron and copper losses along the axis *f-f*. The energy supplied to that axis from the outside diminishes steadily as the speed increases. At no-load and at synchronism *e is equal to the sum of the ohmic losses in the rotor;* that is, to the ohmic losses along *f-f* plus those along *a-a*.

The question as to what happens when such a machine is loaded is answered by the time-phase diagram shown in Fig. 9. This diagram has been constructed on the supposition that Φ_1 and the speed are kept constant, while S supplies a current I_2 leading E_2 by ω degrees. The constant speed chosen exceeds the synchronous by 20 per cent, the corresponding values of E_2, γ and e have been taken from Fig. 7 and are bracketed in Fig. 9 so as to distinguish these no-load values from the corresponding vectors at full load. E, i, Φ_1, er_1 end er_1' have, of course, the same values and stand in the same phase relation to each other as they do in Fig. 8 for 120 per cent of the synchronous speed.

It is seen from Fig. 9 that e must be increased with increasing load if Φ_1 is to remain constant. It should also be noted that the time-phase relation between e and the actual working e.m.f.

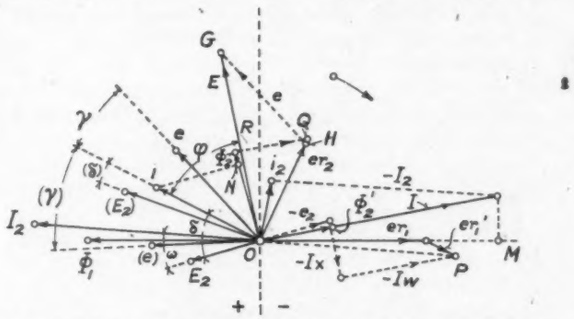


Fig. 9—Complete Load Diagram of the Asynchronous Generator with Mixed Excitation.

E_2 varies with the nature and the magnitude of the load. While e, which is derived from an outside source, determines the periodicity of E_2 at all times, yet it is unable to control entirely the phase of E_2. The apparent power factor of the exciting circuit also varies with increasing load—becoming worse. At no load γ was positive and i was leading e; under load γ has become negative and i now lags behind e. The negative phase angle δ between i and E_2 is seen to increase with the load. The flux of mutual induction Φ_2 of the static transformer *C-S* diminishes with increasing load and approaches the time-phase of Φ_1.

It should be noted that all of the above conditions are greatly exaggerated in Fig. 9, principally on account of the large rotor resistance w which has been chosen for the purpose of making the diagrams clear. The reactance of such a transformer will in practice always be comparatively large, owing to the necessary air-gap between the rotor and the stator, but the ohmic resistance can be kept low. In practice quite a large output per pound of active material is available, but such a machine is not lighter than a corresponding and well-designed heteropolar generator with direct-current excitation.

Fig. 9 makes it also possible to determine quickly the existing torque conditions. A torque may be exerted between i and Φ_2 and another between I and Φ_1. Taking the vertical as reference line and considering all the effective vectors to the left of it as positive, and all those to the right as negative, it is seen that *ON*, which is the projection of i on Φ_2, as well as Φ_2 are positive, whereas Φ_1 is positive while *OM* or the projection of I on Φ_1 is negative. This means that both torques are in the

same direction and that both are *negative*. The machine must have energy supplied to it in order to keep it running. It is seen that the torque due to i is comparatively small; in fact, just about large enough to cover part of the losses in the rotor, whereas the torque proportional to I is very large and is mainly proportional to the load current I_2. The energy required by this machine can be supplied in two ways: either in the form of mechanical torque from the prime mover, or in the form of electrical energy from the outside source which provides the e.m.f. e. It is plain from Fig. 9 that the outside source cannot furnish the energy necessary to deal with the load on S, not even in the case where e has been increased sufficiently to keep Φ_1 constant. The value $ie\cos\gamma$ has varied, but little from no-load to full-load and is now at most just able to cover the losses in the axis f-f of the rotor. Had e been kept constant then i must have diminished with increasing load, thus actually diminishing the energy supplied by the outside source. It is quite clear, therefore, that no help can be expected from that quarter and that *all* the energy required in AB must be taken from the prime mover in the form of *mechanical torque*. In practice the exciting current i will vary but little with varying load, decreasing with increasing load, if e and the speed be kept constant.

Since the periodicity is independent of the speed, then the terminal voltage E_2 of this generator can be kept constant by increasing the speed as the load increases. Another way of achieving the same result is to increase e with increasing load.

It may be stated in conclusion that since the performance of this machine is dependent on commutation it will clearly operate best in the neighborhood of synchronism. It is possible to add a squirrel-cage or other short-circuited winding to the rotor. Such an addition almost entirely relieves the working brushes of the necessity of carrying any current and makes it possible even to dispense with them altogether. When a squirrel-cage winding is made use of in addition to a commuted winding C, then the machine should not be operated at speeds below, or materially above, the synchronous, because then the squirrel-cage along the exciting axis will simply act as a closed secondary with regard to the commuted winding on which e is impressed by way of the brushes f-f. A good deal of useless energy will be taken from the outside source and dissipated in the squirrel-cage, while E_2 will not be constant.

TRANSFORMER CURRENTS IN WEAKENED DELTAS.

By Nicholas Stahl.

It is frequently desired to parallel a number of transformers in such wise that a part makes up certain delta groups, the remainder occurring as banks of open delta or "V." This may occur through a desire to increase capacity by the addition of "spares," insufficient to make a whole number of deltas, or through failure of one or more units originally installed, or through a desire to economize, in the idea that the addition of open delta groups will be adequate.

Many do not realize that this arrangement will, in general, prove either uneconomical as to capacity, if all the units are kept to rated currents, or disastrous to the units on the legs having the smaller numbers, if it be attempted to work all units at overloads guaranteed for single-phase operation.

This is not merely from the additional 15½ per cent additional capacity required on units for open delta service; a further increase in current takes place in the transformers on the partially open legs—considering the whole as several delta groups from which certain members are missing on one or two phases. This increased current is due to change in phase relations, as may be shown in a graphical way, by the following considerations.

Two assumptions will be made for the cases to be considered: first, that the load be balanced, and, second, that the capacity of the system be sufficient to maintain practically constant impressed e.m.f. at terminals of the various combinations.

Now in any open-delta system (single or multiple; if the latter, all angles of the open deltas are connected to same main) the phase relation of currents will be as in Fig. 1; that is currents in legs 1 and 2 in phase with those in mains B and C, and these and main A all equal and 120 deg. apart.

For a straight delta system, the relations are shown in Fig. 2, with 120 deg. between different legs and likewise between

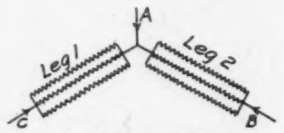


Fig. 1—Open Delta.

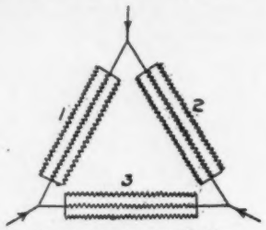


Fig. 2—Straight Delta.

mains. Or, if only interior angles between legs be reckoned, 60 deg. in the latter case.

When to one or more delta groups certain open deltas are added, the diagram in Fig. 3 may represent the relations. It is evident that the phase difference between legs 1 and 2 will now be pulled out from the 60-deg. delta position toward the 120-deg. position, the amount depending on the number of each kind of groups present. That this gives a change of current is clear from the fact that "all deltas" give a current in any leg $= \frac{I_m}{\sqrt{3}}$, where I_m is current in any main, while for "all open deltas" the leg current is that of the main. Or, it may be looked at

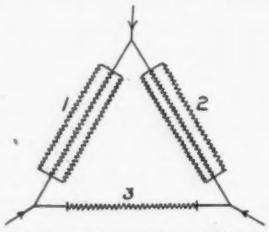


Fig. 3—Delta, One Leg Weak.

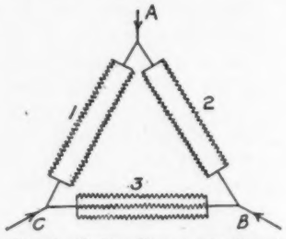


Fig. 4—Delta, Two Legs Weak

thus: the addition of open deltas to delta groups increases the admittance in those legs, which would decrease the potential drop across the leg. This being held constant under the conditions assumed means an increased current in the partly open leg. This is the same as saying there is a different admittance across the several legs, giving greater currents (total) in the full legs, but per transformer greater currents in the weakened leg.

If it is supposed that units be removed from two legs of a delta, the relations may be represented by Fig. 4, and now the greater currents per unit are in legs 1 and 2, by parity of reasoning. It should be noted in both cases, however, that on ac-

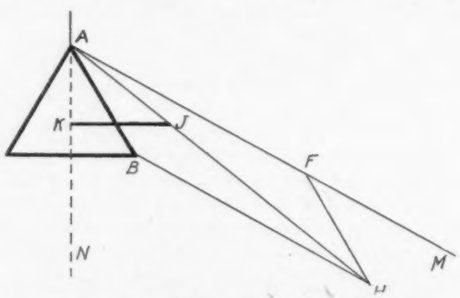


Fig. 5—Diagram, One Leg Partly Open.

count of the change in phase relation this does not make the ratio of currents per unit inversely that of the numbers in different legs; for example, if there are three deltas and two open deltas it might be supposed that in the weakened leg the currents would be 167 per cent of those of the full leg, whereas they are actually only about 124 per cent.

One Leg of Delta Weakened.—For the case shown in Fig. 3 the graphical solution for currents in units in the weakened leg, assuming those in other two legs kept constant, is found by constructing a delta, three sides of which, to any convenient scale represent normal current. See Fig. 5. At point *A* draw *AM*, making 60 deg. with *NA*. Lay off the delta side as many times as there are units in full leg (say, *p*) and along *AB* as many times as there are units in weakened leg (say, *r*). Construct parallelogram and divide *AH* into $p+r$ parts and draw *JK* from end of first, parallel to base of delta. Then 2*KJ* is the current in every unit in weakened leg and $\frac{2JK}{AB}$ is the per cent overload.

Analytically, if *p* and *r* be numbers of units in full and weakened legs, respectively, and I_1 and I_3 the corresponding maximum values of currents; I_a that in any main,

$$I_1=\frac{I_a\sqrt{p^2+pr+r^2}}{p^2+2pr};\quad I_3=\frac{I_a p\sqrt{3}}{p^2+2pr},\text{ and }\frac{I_3}{I_1}=\frac{p\sqrt{3}}{\sqrt{p^2+pr+p^2}}$$

which gives values checking with the graphical solution.

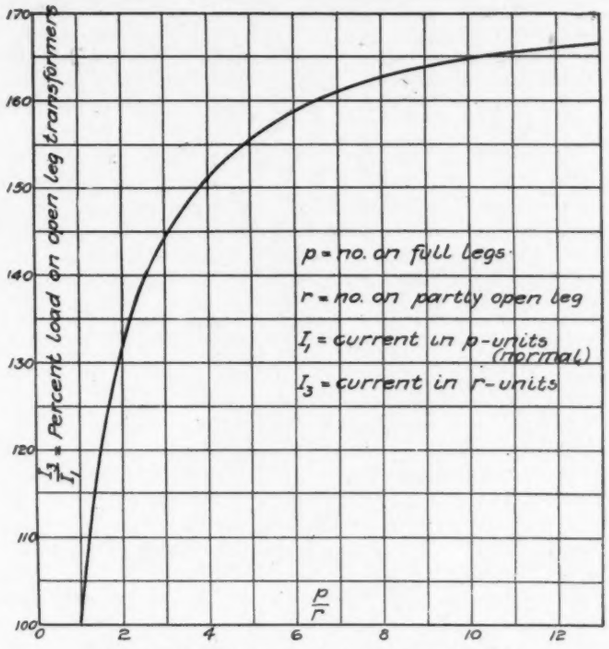


Fig. 6—Transformers, One Leg Partly Open.

The results of either method are shown in curve form in Fig. 6. It will be noted that when the ratio of $\frac{p}{r}$ becomes ∞ the value of current in *r*-units is $\sqrt{3}$ or 1.732, which is the same as saying that the two *p* legs have been pulled into a 120 deg. phase relation with each other.

Results agreeing approximately with the above may be obtained by considering that the current returning from any phase of the load divides through the two parallel paths open to it in the transformer bank, in the inverse ratio of these two paths' impedances. But this method takes no account of the phase distortion, and the discrepancy between the methods increases markedly as distortion progresses—that is, as the ratio of *p* to *r* increases. For a single delta and a single *V*, however, —that is, $p=2$, $r=1$—the difference is slight, amounting to only 2.7 per cent, reckoning full load on the *p* units and overloads on the *r* units. See Fig. 6.

Two Legs of Delta Weakened.—Here is the case of Fig. 4. Solved graphically in Fig. 7, the delta is constructed as before, the delta side is laid off along $CB\,r+\frac{p}{2}$ times, I_c produced to meet the perpendicular *FH* at *H*, *HJ* laid off parallel to base *BC*, when *CJ* will be the required current length, delta side being normal. It is as though the vertex *A* of the delta were stretched out to *J*, but it will be seen that there is no limit to its extension. With this construction *CF* also represents total current in leg *r* and *CJ* that in legs *p* or *q*. The resultant *CH* is perpendicular to *AB*, and with similar resultants along lines of I_b and I_a gives a balanced condition in the mains.

The value of *CJ* is $\frac{\sqrt{r^2+rp+p^2}}{p\sqrt{3}}$, representing $\frac{I_1}{I_3}$, and, of course, is the reciprocal of the value given above.

The resultant for different values of the ratio $\frac{r}{p}$ are shown in curve form (straight line) in Fig. 8.

General Case, Unequal Numbers on All Legs.—The current triangle for single units from all three legs can be most simply

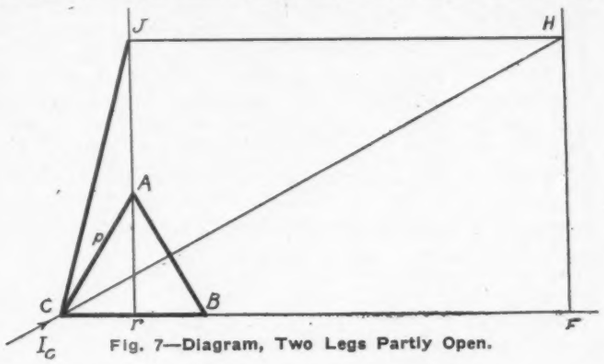


Fig. 7—Diagram, Two Legs Partly Open.

obtained by use of values found by substituting for the particular combination in question, in the general expressions,

$$I_1=\frac{I_a\sqrt{q^2+qr+r^2}}{pq+qr+rp};\quad I_3=\frac{I_a\sqrt{r^2+rp+p^2}}{pq+qr+rp}$$

$$I_3=\frac{I_a\sqrt{p^2+pq+q^2}}{pq+qr+rp}$$

The curves shown in Fig. 9 give values as *r* increases, *p* and *q* being held 1 and 2, respectively. It will be seen that the

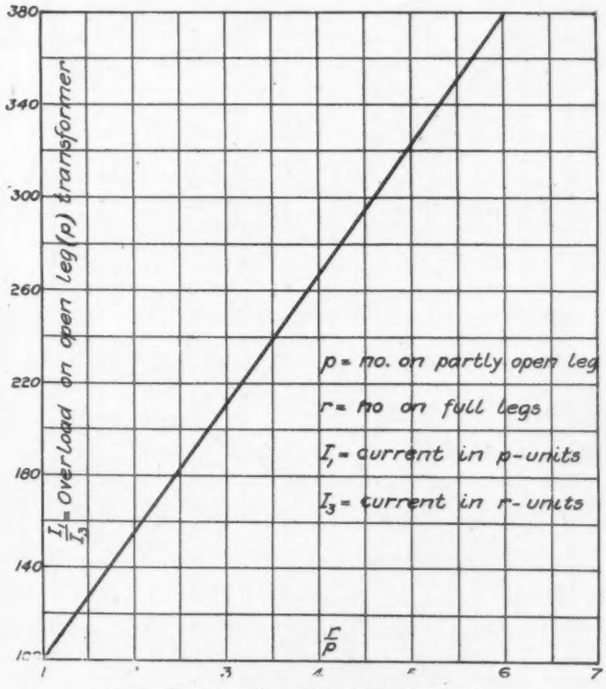


Fig. 8—Transformers, Two Legs Partly Open.

overloads on *p* and *q* units become equal at ∞ and the curves become asymptotic to each other.

The angle α, between the vectors for *p* and *q* legs, is found as,

$$\cos\alpha=\frac{r(q+2r)+p(r+q)}{2\sqrt{(q^2+qr+r^2)(r^2+rp+p^2)}}$$

with symmetrical expressions for β and γ.

Under these conditions, the total power transmitted is assum-

ing $r > q > p$ (that means allowing overloads on q and r legs).

$$EI_3\left[p\sqrt{\frac{q^2+qr+r^2}{p^2+pq+q^2}}+q\sqrt{\frac{r^2+rp+p^2}{p^2+pq+q^2}}+r\right],$$

when I_3 is rated normal current.

But if no overload may be allowed on any leg unit, I_2 and I_3 must be reduced to the ratio of

$$\frac{I_1}{I_3} \text{ or } \sqrt{\frac{q^2+qr+r^2}{p^2+pq+q^2}}$$

For deltas with one or two legs weakened, p equals q in both cases and p r, respectively.

for $p > r$ and overload, the total power is

$$EI_1\left[2p+r\frac{p\sqrt{3}}{\sqrt{p^2+pr+r^2}}\right],$$

for normal loads or less it is

$$EI_3\left[2p\frac{\sqrt{r^2+rp+p^2}}{p\sqrt{3}}+r\right].$$

For $p < r$ and overload, the total power is

$$EI_3\left[2p\frac{\sqrt{p^2+pr+r^2}}{p\sqrt{3}}+r\right];$$

normal load or less

$$EI_1\left[2p+r\frac{p\sqrt{3}}{\sqrt{p^2+pr+r^2}}\right].$$

For example, suppose EI_3 equals 100 kva and we have four deltas, or 12 units giving total of 1200 kva. One unit now goes

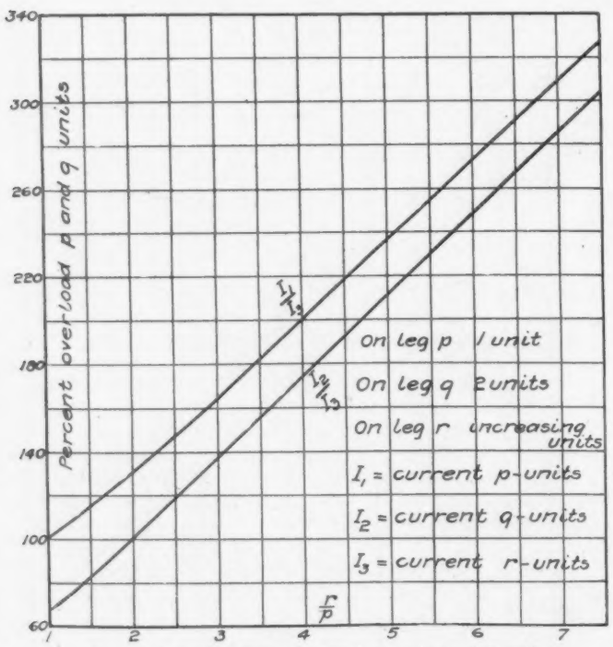


Fig. 9—Transformers, Current in r-Unit Normal.

out, making $p = q = 4$; $r = 3$. With normal rated current in legs p and q

$$\text{Power} = 100\left(2\times 4+\frac{3\times\sqrt{3}\times 4}{\sqrt{16+12+9}}\right) = 1142 \text{ kva},$$

with 14 per cent overload on three units.

If output is reduced to normal on leg r

$$\text{Power} = 100\left(\frac{8\sqrt{16+12+9}}{\sqrt{3}\times 4}+3\right) = 1002 \text{ kva},$$

which means that eight units are operating at 88 per cent normal rating with corresponding decrease in efficiency.

But suppose two units go out on the same leg. $p = 4$; $r = 2$ and power (with overload) = 1062 kva, 31 per cent overload on r units; power (without overload) = 810 kva, 76 per cent load on p units.

Should they go out, however, on different legs, $p = q = 3$; $r = 4$, power (with overload) = 1102 kva, 17 per cent overload, power (without overload) = 942 gva, 85.5 per cent load.

It is evident that the second arrangement is preferable from every point of view—load rating, efficiency, overloads and underloads—132 kva additional rating might be gained with greater loads on the units operating under normal by changing the position of additional unit in the bank. In general, what tends toward balance is of advantage.

Moreover, if it be elected to run at overloads in emergency, the second arrangement gives 40 kva additional with 17 per cent overloads, instead of 31 per cent. To be sure, they exist on four units instead of two, but are within the generally guaranteed values.

This same reasoning may be employed with profit in a projected increase in station rating, both with respect to initial cost and efficiency of operation, though increase in the latter is small.

A 100-kva, 60-cycle unit, costing, say, $400, may have efficiencies of 95.5, 97.3, 97.8 and 97.9 at one-quarter, one-half, three-quarter and full loads. If the installation consisted of nine identical units, or 900 kva, and if 1000 kva were required, the new unit placed in any leg would give the 1000 kva with only 16 per cent overload, or if the 1102 kva available be taken, the cost per kilovolt-ampere added is $\frac{400}{202}$, or $1.98, whereas if delta is arranged with only one weak leg, the rating needed is secured at only 28.5 per cent overload and cost per added kilovolt-ampere is $4.00.

A mechanical analogy—which must not be pressed too far—to illustrate phase distortion and increased currents in weakened legs may be found by considering transformer banks as shown in Figs. 3 or 4, as made up of elastic cords—one for each unit, the length of any cord corresponding to the current in it.

Currents in the mains are represented by cords which may be either elastic or inelastic, but under conditions of symmetrical balanced load are 120 degrees apart. That the vector sum of currents in the mains is zero, is indicated by the static balance of the system as a whole, that is, it shows no tendency to move in any direction. The tension in any of the elastic cords is proportional to its elongation. Normal current is then represented by any arbitrary elongation, which will be the same in all units, when, and only when, $p = q = r$.

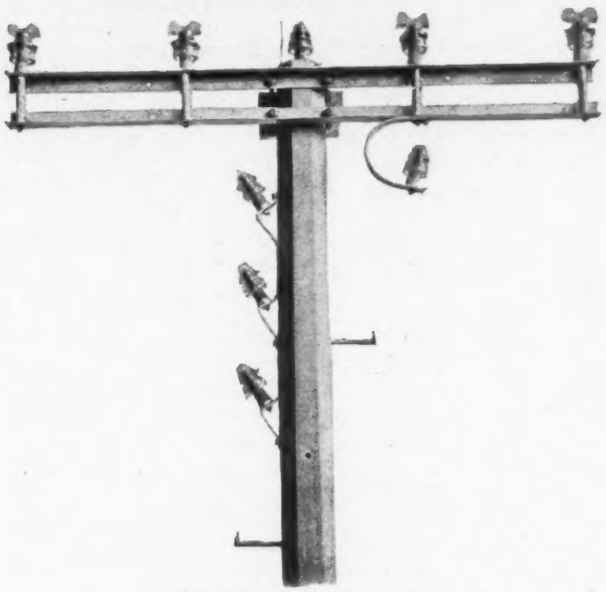
In the use of such an analogy, elastic tension in cords—corresponding to electric currents—should be carefully distinguished from electric tension in conductors. Mechanically it is action and reaction—Newton's third law of motion; electrically it is Ohm's laws (for alternating currents); current proportional to e.m.f.—when the impedance is constant.

CONCRETE POLE CONSTRUCTION IN NEBRASKA.

Mr. C. A. Snider, of Auburn, Neb., showed a sample of a concrete pole top and gave a short talk on the subject of reinforced-concrete poles before the convention of the Nebraska Electrical Association, at Lincoln, Neb., May 4. An illustration of this pole top as exhibited at the convention is shown herewith. He stated that his company at Auburn (the Auburn Mutual Lighting & Power Company) had built about 2 miles of concrete pole line. The shortest pole that had been made is 38 ft. long and the longest 60 ft. The mixture employed in the manufacture of these poles is 1 of cement, 2.5 of fine crushed stone and 4 of sand. The poles are octagonal in shape and have four reinforcing rods. The forms in which these poles are made are open on one of the sides of the octagon, and this side is finished off with a trowel. The concrete is allowed to set in the forms 24 hours. After the forms are removed, the pole is allowed to lie for 15 days. To insure good setting, the concrete is wet from time to time, unless there are frequent rains.

After the 15 days have elapsed, the poles are piled up and allowed to set for 90 days more. After that they can be handled almost as roughly as wooden poles. On account of the weight of these poles, the best way to haul them to point of use is on bob sleds in winter if this is possible. The concrete is made very wet and is very thoroughly tamped. The reinforcement on a 40-ft. pole consists of four ⅝-in. twisted steel rods or corrugated bars of the same size. To make a 40-ft. pole about 200 lb. of steel and four sacks of cement are required. The total weight is between 2800 and 3000 lb.

The cost of such a pole is $7.65 ready to set. The cost of



Concrete Pole Top.

setting of a 40-ft. pole he gave as $3.30. On poles 40 ft. long and over concrete costs less than Idaho cedar in Auburn. Each cross-arm on the pole shown consists of two pieces of galvanized angle iron, held a fixed distance apart by a short length of iron pipe, through which passes a long bolt extending up through the center of the wooden pin on which the insulator is screwed. A short length of wire connected to the steel reinforcing rod is allowed to project out of the top of the pole, as a lightning rod. On a mile of concrete pole line carrying secondary lines from which services are tapped, no meter has been burned out by lightning. It is the practice of his company to run service lines one above the other, because in many places telephone lines are above the service lines, and these telephone lines dropping across the service line would cause short-circuits if both service wires were of the same height. By placing one above the other, such short-circuits are partially prevented. On poles over 45 ft. long, six reinforcing rods are used instead of four.

Three men will set three 40-ft. poles per day. If the poles are over 40 ft., only two poles per day can be set by the same crew. The pole steps are set in the forms when the concrete is put in. After the forms are removed, the steps are unscrewed to prevent their damage in handling the pole. After the pole is set, these steps are screwed into the poles, beginning at the bottom. The cross-arms are bolted on after the pole has been set. The octagonal forms for these poles are made in three pieces. A 60-ft. pole is 14 in. square at the butt. On the construction work at Auburn the average length of haul was three-quarters of a mile, and the cost last winter was 50 cents per pole. In conclusion Mr. Snider said that the rapid rotting of wood poles makes the central station man think seriously of something better for the larger sizes.

DISCUSSION.

Mr. Donnelly of the Bell Telephone Company gave the average price of a 40-ft. pole set in his company's experience as $19.11. Of this the setting amounts to $6. This includes work done both in the city and out in the country. For a 50-ft. wooden pole the cost is $26.22. Mr. Snider explained that in digging a hole for these concrete poles it is his practice to trench the hole back to a distance about equal to the depth of the hole, in order to make it easier to slide the pole into the hole.

Mr. Robert M. McCandlish, of Holdredge, reported having made a limited number of concrete poles. They used four reinforcing rods to the pole. These poles were set with a gin pole and a block and tackle. The cost has been about $14 each for 30-ft. poles set. In answer to a question, Mr. Donnelly said that the cost of digging holes for these high poles in his company's average experience was $1.24 per hole. Seven men will set 60 poles of 40-ft. length per day. Mr. E. A. Bullock, of Norfolk, said that 30-ft. wood poles cost new about $2.42, and the cost of setting was 75 cents.

Mr. Snider said that two 60-ft. poles which he had set cost $22.65 ready to set and $5 each to set, making a total of about $28 set. The price of Idaho cedar poles in his town in 60-ft. lengths is $29.60. Mr. Bullock said that the low freight rate on Idaho cedar poles to Nebraska had so far saved the day, as otherwise concrete poles would have come in before this.

Central Station

Management, Policies and Commercial Methods

CENTRAL STATION SERVICE FOR THE ELECTRIC VEHICLE.

Pursuing its policy of encouraging the use of electric vehicles, the Commonwealth Edison Company of Chicago has issued a convenient and useful "Handbook for Users of Electric Vehicles." This book, which is suitable in size for the pocket, consists of 24 pages, and gives practical information of value in the care and maintenance of the electric vehicle, both for pleasure and commercial purposes. Some of the subjects treated bear the following headings: "General Rules and Instructions," "Storage Batteries," "Capacity Rating of Storage Batteries," "Specific Gravity Reading" and "Directions for Reading Kw-Hour Meters." In addition, there is a general introduction, pictures of a model garage, a hydrometer and of various forms of meters. A map giving the location of public charging stations in Chicago and facsimiles of bills for electricity consumed under varying conditions are also included. The little book is of practical value to users of electric vehicles, and should be of real usefulness to central-station customers of this description.

PREVENTING "CURB-STONE" METER READING.

Fortunately, the "curb-stone" reading of electric meters is less prevalent than in the case of water and gas meters, which are usually mounted in inaccessible places and are hard to get at. In all three cases, however, there is sometimes a strong temptation acting to cause the inspector to attempt reliance on the figures of the last month's reading as being approximately those of the present consumption, and to save himself trouble by simply marking into his book this estimated amount without ever having even looked at the meter itself. Especially is this true where the meter-reader has before him the record of con-

sumption for a number of previous months, each showing about the same number of units consumed. Instances have been known where one or two such readings were thus reproduced half a dozen times. Then when a new man, addicted to the same practice, read the meter and found that the total dial indication was much below the total on his book (the consumer having meanwhile increased his demand slightly over each of the several months the meter remained unread) this new total difference was taken as the new consumption, and again reproduced for a month or two before the customer "kicked."

To guard against such careless reading of its meters, the Pine Bluff Corporation, which furnishes electricity, gas and water to the town of Pine Bluff, Ark., has adopted a meter-reading book in which the monthly lines are given in reverse order from the bottom of the page. Then, as the loose-leaved books are turned in to the accounting department each month, the last line, showing the meter indication of the present month, is clipped off, leaving a blank record page, and giving the inspector next time no clue of the previous month's dial standing. At the top of the page, of course, the customer's name, address and number and make of meter are entered, once for all, each page of the reader's book serving for one year. In the case of the Pine Bluff Corporation, an important saving has been found to result from the present practice of having but one man make the rounds, reading gas, electric and water meters at the same time, and entering all figures on the same page for each customer. The lines clipped from the meter-reader's book are destroyed, no effort being made to retain these original figures as a matter of permanent record.

SOLUTION OF CONDENSER-WATER PROBLEM AT HOT SPRINGS, ARK.

The 1500-kw electric generating station of the Hot Springs Water Company, at Hot Springs, Ark., until recently utilized, or attempted to utilize wholly, for condensing purposes the discharge water from the famous springs, which finding its way down a dry stream bed near the plant, was the only water at all available.

In winter and spring the hot waters from the government reservation, which issue from the peculiar igneous rock structure at a temperature of 160 deg. Fahr., are considerably augmented by the flow from various cold springs further up the valley. During these seasons of the year the natural flow amounts to about 4,000,000 cu. ft. per day, and being at a resultant temperature below 70 deg. Fahr., can be used satisfactorily in the jet-type condensers serving the turbine and engine-driven units in the station.

In the summer months, however, owing to the interruption of the cold-spring supply and the higher outside temperature, the flow past the plant is considerably diminished and reaches 85 deg. to 90 deg. Fahr., so that the condensers are severely taxed at the times of peak load.

The situation remained a problem for some time, with apparently no simple solution in sight, until it was finally recalled that there was still in commission for emergency use a small 50-hp pumping station several miles above the city, which formerly comprised the local water works. From this station 2 miles of 8-in. pipe connected to the city mains at a point near the dry bed of the creek which is culverted under the principal street of the town. Accordingly a T was installed at this point, and a valve arranged to discharge the pumped supply from the 8-in. pipe into the dry creek bed. The little pumping station has a delivery capacity of 700,000 cu. ft. per 24 hours. During the warm days of the year, an operator is dispatched to this outlying pumphouse and instructed to start the pumps at 4 p. m., running them at full capacity until about 9 p. m. The water thus delivered from the neighboring river finds its way, in about 2 hours, down through the pipe line and dry creek bed beneath the city, and is available for condensing duty during the lighting load, which lasts from 6 p. m. to about 10 p. m.

This solution of Hot Springs' condenser-water problem will doubtless offer suggestions of value in other situations, where the existing flow is insufficient, and the region above the plant contains available sources of supply.

FORM OF CUSTOMER'S BILL.

The form of customer's bill shown in the accompanying reproduction, and used by the Pine Bluff (Ark.) Corporation,

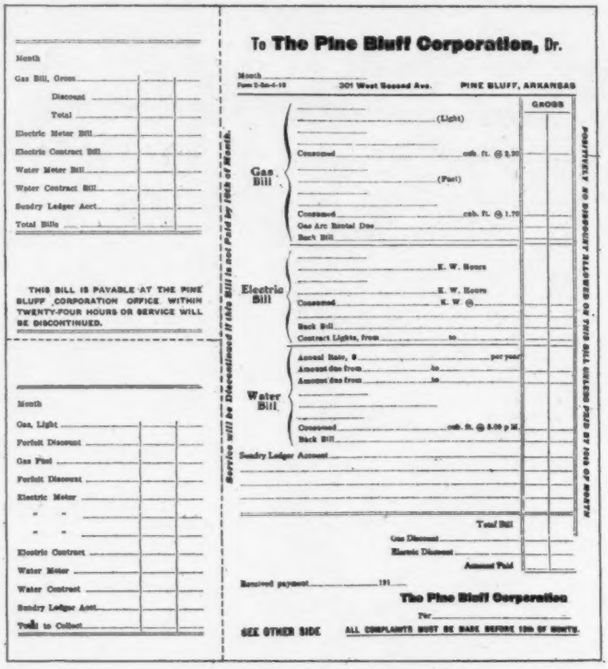

To The Pine Bluff Corporation, Dr.
PINE BLUFF, ARKANSAS
GROSS
Gas Bill
Electric Bill
Water Bill
Sundry Ledger Account
Total Bill
Received payment
The Pine Bluff Corporation
SEE OTHER SIDE
ALL COMPLAINTS MUST BE MADE BEFORE 10th OF MONTH.
THIS BILL IS PAYABLE AT THE PINE BLUFF CORPORATION OFFICE WITHIN TWENTY-FOUR HOURS OR SERVICE WILL BE DISCONTINUED.

Fig. 1—Form of Customer's Bill.

serves at once as the monthly statement, delinquent notice, cut-off statement, and cash slip. The address is first printed by addressograph at the top of each of the three perforated

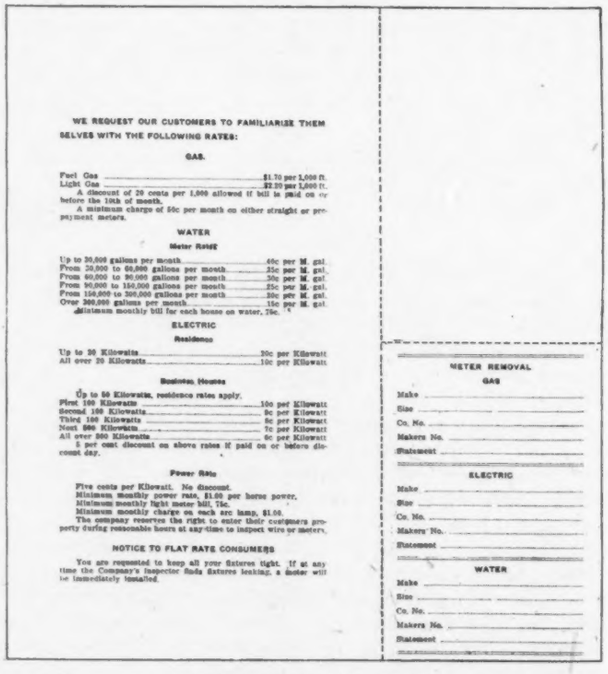


Fig. 2—Reverse Side of Bill.

forms, and the various amounts are entered in their places, the entire form being filled in complete at one time. On the date

of billing, the statement is separated along the vertical perforated line, the right-hand side being sent to the customer, while the stubs on the left are filed in cases at the office. If the customer pays before the lapse of the discount period, the upper left-hand stub is returned as a cash slip. However, if the 10-day time is exceeded, this form is itself mailed out as a delinquent notice, the net statement (which it necessarily gives for service as a cash slip) being corrected to the gross undiscounted amount. Twenty-four hours later, if the customer has not paid, the cut-off man is given the remaining lower stub, with instructions to get the money or the meter. Both time and trouble are saved, it is reported, by making up the form complete at the one time, although, of course, the majority of the stubs thus filled out are saved from serving their purpose as delinquent and cut-off statements, and are destroyed without being used.

NEBRASKA POWER PLANT REPORTS AND ROUTINE.

Mr. G. S. Sprague, of Geneva, Neb., gave a paper on "Power Plant Reports" before the Nebraska Electrical Association, at Lincoln, May 4. Out of 14 central stations which had responded to his inquiries, six were keeping daily report sheets. One plant reported having two bins, which are alternately filled from the cars and the car weights taken. In this way the weight of coal used can be obtained from the car weight, which is assumed to be accurate.

Of the plants reporting to Mr. Sprague, the best had a consumption of coal per kw-hour of 8.85 lb.; one 9 lb.; one 12 lb., and one 13.72 lb. One plant reported a consumption of 8.3 to 9.3 lb. condensing and 10.5 to 12.5 non-condensing. Mr. Sprague's plant at Geneva consumes 14 lb. per kw-hour on some of the less economical runs, and as low as 7 lb. on the more economical runs under favorable conditions.

Mr. M. A. Kemmish, of Lincoln, followed Mr. Sprague's paper with a paper on "Power Plant Operation." In order to be sure that oiling and inspecting of all kinds are not neglected or forgotten, it is necessary to have a regular system of making the rounds at stated intervals. Inspection and overhauling of engines and other apparatus should also be done at regular predetermined intervals. It is not sufficient to wait until a piece of apparatus begins to give trouble, and a regular system of inspection will usually locate trouble before it begins to show itself. He cited a case, a break in a steam line, when the valve stuck and the whole plant was shut down, whereas if the valves had been regularly looked after this would not have happened. A loose nut, for example, will not be located unless there is a regular system of inspection.

A competent boiler-room foreman will not work for $1.75 a day, hang his clothes in a dirty boiler room and wash in an old pail. Fuel is so high in Nebraska that the coal question is important. The coal that is the highest in heat units may not be the cheapest, nor is the high-priced coal necessarily the best to use with the stokers or grates with which a plant is equipped. The coal should be tested under actual plant conditions, and tests should be conducted at stated intervals. Mr. Kemmish did not favor the regulation of the draft to a boiler by means of the ash-pit doors. This should rather be done by a damper in the smoke pipe. If the ash-pit doors are closed the tendency is to draw in air through leaks in the sitting, this being detrimental to economy and harder on the boiler. He noted that the coal burned per square foot of grate area is being increased recently, and chimney heights are also being increased as boilers are worked at a higher rating than formerly.

Boiler scale reduces the evaporation and increases the repair bills. Of two general ways of treating scales, one is to soften the water before it enters the boiler, and the other is to mix compounds in the water as it enters the boiler. For the first method there is the well-known treatment with lime and soda ash to precipitate the scale-forming matter, after which the water is settled. It is evidently of vital importance to treat the water with enough of these chemicals to precipitate the solids. He stated in general that a water having 4 grains or more per gallon can be best treated by settling outside of the boiler, while if there are less than 4 grains per gallon, treatment in the boiler is best. Treatment of the water after it goes into the boiler causes a sediment, which, of course, must be blown off, and heat is lost in the blowing-off process.

Leaks of air through boiler setting and lack of pipe covering are common sources of loss. Most engines work with best economy at about one-quarter cut-off. He suggested that in some cases it is possible to change the speed of the engine by changing pulleys, so as to make the engine operate nearer to one-quarter cut-off under ordinary conditions. The reciprocating engine works best above atmospheric pressure, while the turbine works at best economy below atmospheric pressure. The combination of the low-pressure turbine with the reciprocating engines gives great economy. It is usually a mistake to throw out an engine and replace it with a turbine when a low-pressure condensing turbine could be added to the engine.

In the discussion, Mr. E. A. Bullock, of Norfolk, strongly expressed his opinion that any system of reports which are dependent upon the men who do the work are useless. A man should not be called upon to keep a record on himself. If a continuous record of the temperature of the flue gases and the amount of carbon dioxide in the gases can be kept, the management has means of knowing fairly well what has been taking place.

NEW BUSINESS DISCUSSION AT NEBRASKA CONVENTION.

By way of introducing the papers and discussions on new business at the Nebraska Electrical Association convention at Lincoln, May 4, President B. C. Adams said that when companies invest money in new business, they are building for the future. Economies in operation frequently will not save the day without an increase in business. A paper written by Mr. S. A. Fletcher was read by Mr. Harry Glass, of Pittsburgh. Mr. Fletcher classified the industries which may use electrical power in the three main divisions. First, those which derive the greatest benefit from electrical service, because of their low load factor and consequent high investment charge per unit of power used. Second, those whose demand is largely constant throughout the day, but whose scattered location of buildings, etc., demand an economical system of power distribution; and third, the long-hour power users who can be persuaded to fill up the hollow by using power after midnight and before the day load proper begins, thus earning a very low rate for power. Planing mills, machine shops, blacksmith shops, small factories and foundries, as well as printing presses and other miscellaneous industries, come in the first class. In the second class are brick plants, ice plants, pipe foundries and paper mills. In the third class are municipal water-pumping plants and such other pumping as may be done during the night.

He gave particulars of a small flour and feed mill as an example of the second class. The capacity of the flour mill is 60 barrels per day and it, together with a corn mill, is driven by a 50-hp motor. The feed mill is driven by 20 hp. The power required by the flour mill averages from 375 kw-hours to 400 kw-hours per day, varying according to the weather conditions. On a cold damp day the belt friction is considerably increased. The maximum requirement of the flour mill is 44 kw when first started, and for the corn mill 9 kw, or a total of 53-kw input to the 50-hp motor. Two-thirds of the power required by the flour mill is consumed in overcoming friction, as the average friction load is 26 kw and the average combined friction and machine load, 39 kw. As examples of the third class he gave the information shown on the accompanying table of pumping installations operated by smaller central stations.

As practically no pumping load need be on at the time of the peak, the contract may include a clause regarding the hours of use, and a low rate made. It is an easy matter to figure the

horse-power required to do a given piece of work knowing the height the water is to be raised, and making allowance for pipe friction and the efficiency of the pump, which latter may be obtained from the manufacturers with sufficient accuracy. Thus, for triplex pumps with capacities of 75 gal. per minute and over, the efficiency for heads of 50 ft. to 100 ft. is 50 per cent; 100 ft. to 200 ft., 60 per cent; 200 ft. to 300 ft., 70 per cent; 300 ft. up, 80 per cent. The variation in efficiency is due largely to the fact that the friction of the pump does not change materially with the head. For centrifugal pumps the efficiency may be a very variable quantity, but for sizes under 75 hp, it is safe to assume 50 per cent.

Mr. Glass then presented in abstract his paper given at the Iowa Electrical Association and abstracted in the issue of May 5.

DISCUSSION.

Mr. S. F. Dibble, of Chicago, thought it important that the central-station company should control the sale of motors even if it does not actually sell them. In many cases the central-station company can afford to spend the time and effort to sell motors where the dealer could not, as the latter must depend upon the immediate profits of sales. He thought the central station should get the agency for one good make of motor. It should also have a stock of motors on hand ready for emergency. Each company should have one man who is held responsible for the growth of the motor business. If there is not enough business to employ all of one man's time, he can divide it between the motor business and other things.

Mr. B. C. Adams, of Lincoln, as showing what the building up of motor load can do, cited the case of the Lincoln Gas & Electric Light Company, of which he is general manager. Last year in April his company sold 90,000 kw-hours to the Citizens' Railway Company. This railway was later sold to a competing company, but during the year the Lincoln Gas & Electric Light Company has secured 80,000 kw-hours of load to make up for the anticipated loss of the railway load, most of which gain was in motors. Many of these motors were placed on approval and sold either for cash or on the installment plan.

Mr. Harry Glass in answer to some questions as to the methods used in some of the brick plants referred to said that the waste heat from the kilns was used for drying. Mr. E. A. Bullock, of Norfolk, commented unfavorably on the reduction in weight of motors now manufactured as compared to those of a few years ago. Carrying a stock of motors was not practicable, he thought, for a small company like his. Mr. L. J. Schwingel, of Holdredge, said that he carried a stock of motors from 15 hp in size down in order to be ready to answer immediately requests and to be able to loan motors in case of breakdown. Mr. Bullock replied that Mr. Schwingel at the present rate would have his town saturated in three years more, and then what would he do about carrying a stock? He complimented the manufacturers on having established departments to assist central stations in selling motors. Mr. Dibble answered Mr. Bullock's question about the weights of present motors by saying that there is not now as much waste material in motors as there was formerly. The iron and copper are used to better advantage. The overload guarantees for any given size of motor are the same as were made several years ago. The efficiency and power factor, however, are better. He thought the central station should keep some kind of a stock of motors for emergencies, breakdowns, etc. Mr. Harry Glass told of troubles experienced on the West Penn Railways Company system in Pennsylvania by dealers selling the largest motors possible to a consumer. The result was loading up the company's line with motors of low operating efficiency and low power factor under the loads which they had to carry. The central-station company had to get itself in position to sell motors at actual cost if necessary to stop this bad practice by dealers. One dealer quickly saw the reasonableness of the company's position and began to sell motors in accordance with the policy desired by the company. Others were short-sighted enough not to fall in line, and made objections which, of course, were of no avail.

Mr. G. S. Sprague, of Geneva, Neb., said that he had operated a day circuit in his town of 2500 population one year. He had made a test on a 100-barrel flour mill to determine the exact cost of operating this mill by steam. He then made motor rates to figure out the same gross amount per month. This rate was 3 cents per kw-hour. Mr. Glass said that a flour-mill load is the best class of business except water pumping. Mr. Adams commented on the fact that although laundries require steam for laundry operation, there are several laundries on central-station motor service in Lincoln. As to motor sizes, Mr. Sprague remarked that the manufacturers of the mill machinery had recommended that an 80-hp motor be put in the mill which he tested. He found, however, that the average load was only 40 hp. A 50-hp motor was installed.

ELECTRIC PUMPING INSTALLATIONS.

Location	KW Capacity of Station	Gals. Pumped per Minute	Type of Pump	Total Head in Feet	Capacity of Motor	Average H.P. Required	Speed of Motor	How Connected to Pump	Hours Pump is Operated	Cost per Million Gals.	Remarks
Nevada, Iowa....	110	100	Deep well plunger double acting....	460	15	12	1165	Belted.....	Midnight to 6 a.m.	$63.33	Formerly cost double with steam.
Sikeston, Mo.....	150	500	Triplex double acting.....	273	35	....	600	Geared.....	When C.S. desires.	20.00	For fire service.
Holdredge, Neb..	200	60	Piston single acting.....	160	15	4	....	Belted.....	3 hours per day...	.....	For office building.
Beatrice, Neb....	275	50	Piston single acting.....	....	2	....	....	.....	24 hours.....	.....	For ice plant.
Charles City, Iowa	300	60	4-stage centrifugal	250	10	....	1200	Belted.....	.....	120.00	For spraying in greenhouse.
Ottawa, Kan.....	385	1000	Centrifugal.....	....	2–40	....	....	Direct connected by 30-ft. shaft.	11:30 p. m. to 5:30 p. m.	15.00	Pumps from river to sed. basin. Brings day load up to about 80 per cent. of peak.
Roanoke, Va.....	800	418	3-stage centrifugal	260	75	....	1150	Coupled.....	11 p. m. to 6 a. m., 1:30 p. m. to 5:30 p. m.	36.50	Min. water supply. Helps load factor materially.

Wiring and Illumination

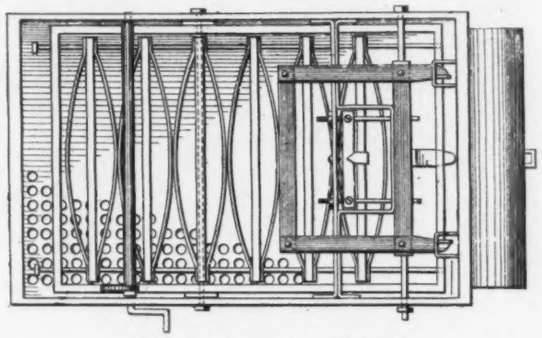
TWO-PHASE DISTRIBUTION AT FT. SMITH, ARK.

Ft. Smith, Ark., is served by a two-phase, 110-220-volt distribution system for light and power. The 110-220-volt, three-wire lines from one phase are carried along one side of the principal thoroughfare, Garrison Avenue, a similar circuit from the second phase being brought along the other side of the street. This arrangement, besides securing a very close balance of lighting load on the two phases, makes it only necessary to bring taps from the opposite phase across the street in case it is desired to operate a 110-volt or 220-volt motor at any point. A similar scheme is employed in the distribution circuits traversing the cross-town alleys. Adjacent alleys contain alternate phases, so that if it becomes necessary to install a motor in any part of town touched by the lighting lines, the second phase connection can always be secured within one square.

It is now planned to extend a series of separate and independent power circuits through the downtown and residential portions of the city, following this method of alternate phase lines. Mr. A. Patterson is electrical superintendent of the Ft. Smith Light & Traction Company.

THERMALLY RELEASED FIRE ALARM.

An ingenious trip for operation with a predetermined rise in temperature is described in a patent for a fire alarm recently granted to Mr. Edmond Lamoureux, of Montreal, Canada. As shown in the accompanying sketch, the thermal element consists of a row of compound expansion bars mounted to slide upon parallel rods. These expansion bars are of a well-known double type, in which a stiff bar of one metal has riveted to its extremities two slightly longer strips of a different metal which



Thermally-Released Fire Alarm.

has a larger thermal expansion coefficient. The resulting structure resembles a carriage spring in external shape, and due to the unequal expansion of its parts, varies its transverse dimension with the temperature. The result of setting a number of these bars side by side is to accumulate their individual expansions, thus securing quite an appreciable movement with a change in temperature. In the device illustrated, the expansion bar at one end of the row is fixed; that at the other carries a hook or trigger which can be set to release a spring thereby closing an alarm circuit when the temperature exceeds the predetermined value.

THE BEARING OF REFLECTION ON ILLUMINATION.

The Limits of Reflection as Disclosed by the Absorption-of-Light Method of Calculating Illumination.

BY A. S. MCALLISTER.

One of the problems connected with illumination which has usually been considered too complicated to admit of simple calculation is that dealing with the reflections and inter-reflections from and between the ceiling, floor and walls of a room. It has long been appreciated that the light from a lamp impinging directly upon a reflecting surface, such as a wall of a room, is partly reflected and strikes, say, an opposite wall; it is partly re-reflected and again strikes the first wall, where it is once more partly reflected, etc. The solution of the problem connected with these inter-relations has generally been based on formulas involving the higher branches of mathematics. In practical illuminating engineering work the problem has been looked upon as being so complicated that use has been made of some approximate solution based largely upon the knowledge of results obtained previously under similar conditions. It is the purpose of the present article to outline a method possessing arithmetical simplicity, which affords a clear insight into the relations involved in counter-reflections, and gives results which should prove of much importance in many illuminating problems.

The method to be discussed has as its foundation the absorption-of-light method of calculating illumination as described in the issue of this paper for Nov. 21, 1908, on page 1128. According to this method, the lighting units in a room must produce the sum of the lumens absorbed by the various surfaces, the lumens absorbed by each surface being determined as the product of the area of the surface in square feet, the incident illumination density in ft.-candles, and the absorption coefficient. Being based on nature's law of conservation, this method is absolutely exact, and should not be considered as a mere approximation; any error resulting from applying the method in practice is attributable to errors in assigning the proper values to the "constants" involved, and does not indicate inexactness with reference to the method itself. The method gives no clue as to the distribution of illumination over each surface, but takes fully into account all of the inter-reflections between the various surfaces, and permits one to ascertain the total amount of light which the lamps must supply directly to each surface involved. Moreover, it discloses in a convincing manner certain limitations encountered in illuminating installations which have usually been ignored in applying other methods.

The significance of the remarks just made can best be appreciated by applying the method under certain assumed conditions, which are within the range of possibility, but somewhat unusual. For the purpose of avoiding all unnecessary complications, consider first the relations in an extremely narrow, long hall of great height, against one wall of which a total light of, say, 2000 lumens (160 mean spherical candles) is sent directly from the lamps, the other wall being illuminated exclusively by the light reflected from the former wall; assume that the light-absorption coefficient for each wall is 0.20. The problem is to determine the total incident flux on each wall and the amount absorbed by each. Assign arbitrarily a value of 100 units to the total light incident upon the first wall. Eighty per cent, or 80 units of this light, are reflected to the other wall where 20 per cent, or 16 units, are absorbed, 64 units being returned to the first wall. Thus, of the 100 units reaching the first wall 64 are reflected from the second wall and 36 come directly from the light sources. The 36 units of light are equal to 2000 lumens, so that each unit has a value of 55.55 lumens. It is seen, therefore, that on the first wall the incident lumens have a value of 5555, of which 2000 come directly from the lamps and 3555 are reflected from the second wall; the second wall receives $5555 \times 0.80 = 4444$ lumens, and reflects $4444 \times 0.80 = 3555$ lumens to the first wall. The former wall absorbs $5555 \times 0.20 = 1111$ lumens, and the latter $4444 \times 0.20 = 888$ lumens, the total being the 2000 lumens produced by the lamps.

As one should have anticipated, the calculations noted above show that, quite independent of the wall upon which the light falls directly from the lamps, the illumination upon one wall cannot differ from that upon the other by more than 20 per cent when the light-absorption coefficient has a value of 0.20. The same relative relation holds true for any value of the absorption coefficient, provided only that the two walls are so situated that all of the light reflected from the one falls upon the other.

It is well to investigate also the limits of inter-reflection between two oppositely facing walls having different coefficients of absorption. Assume, therefore, conditions to be the same as above, but assign to one wall an absorption coefficient of 0.10 and to the other a coefficient of 0.50, and determine the effect of directing 2000 lumens toward first the one and then the other wall. Proceeding as above, assign arbitrarily a value of 100 units to the total light incident upon the wall having the 10 per cent coefficient, toward which the light from the lamp is first directed. Ninety units are reflected to the second wall, where 45 are absorbed and 45 returned to the first wall. Of the 100 units on the first wall 45 come from the second wall and 55 from the lamps. The 55 units equal 2000 lumens and hence each unit is 36.36 lumens. Therefore, 3636 lumens fall on the first wall, 2000 coming from the lamps and 1636 from the second wall. The second wall receives $3636 \times 0.90 = 3272$ lumens and returns $3272 \times 0.50 = 1636$. The former wall absorbs 3636

$\times 0.10 = 363.6$, and the latter $3272 \times 0.50 = 1636$, the total light absorbed being 2000 lumens.

Consider now that the light from the lamps falls first on the wall having a coefficient of 0.50, and assign an arbitrary value of 100 units to the total light incident upon this wall. Fifty units are reflected to the other wall where $50 \times 0.90 = 45$ are returned to the first wall. Hence, of the 100 units reaching the first wall, $100 - 45 = 55$ come from the lamps directly, so that each unit equals 36.36 lumens. The first wall receives 3636 lumens, 2000 of which come from the lamps and 1636 from the second wall, which receives $3636 \times 0.50 = 1818$ from the first wall. The first wall absorbs $3636 \times 0.50 = 1818$, and the second $1818 \times 0.10 = 181.8$, the total absorption being 2000 lumens.

A striking result is shown by the example just given, namely, that, quite independent of the wall upon which the 2000 lumens from the lamp fall directly, that wall receives an incident flux of 3636 lumens, while the other wall receives a value less than this amount by the light absorbed by that wall upon which the rays from the lamp are directed. With the rays directed toward the wall having a low absorption coefficient the other wall received 3272 lumens, while with the rays in the opposite direction the indirectly lighted wall received 1818 lumens. It should be evident from the above that reflection may play a highly important part in illumination, and that the direction of the light from lamps becomes of less and less importance as the coefficient of absorption decreases. In any event, the absorption-of-light method of calculation affords a valuable insight into the limitations upon the distribution of illumination between inter-reflecting surfaces, and represents a convenient simple method for solving certain of the problems in illumination usually considered complex.

It is interesting to apply the absorption-of-light method to the determination of the exact amount of flux which the lighting units must direct toward each of two inter-reflecting surfaces illuminated to different light densities and having different absorption coefficients. Assume that in a room 10 ft. wide by 15 ft. long, having a ceiling absorption coefficient of 0.20 and a floor coefficient of 0.90, the incident ceiling illumination is to be 1 ft.-candle and the incident floor illumination 3 ft.-candles; neglect the reflection to and from the walls from and to the ceiling and floor, or rather assume that the light received by the walls from the ceiling and floor is equal to that reflected from the walls to the other surfaces. The total incident ceiling illumination will be $15 \times 10 \times 1 = 150$ lumens, of which $150 \times 0.20 = 30$ are absorbed and $150 - 30 = 120$ are reflected to the floor. The incident illumination on the floor will be $15 \times 10 \times 3 = 450$ lumens, of which $450 \times 0.90 = 405$ are absorbed and $450 - 405 = 45$ are reflected to the ceiling.

Of the flux of 150 lumens on the ceiling 45 come from the floor, so that the lamps must supply $150 - 45 = 105$ lumens. Similarly, the lamps must supply $450 - 120 = 330$ to the floor. The ceiling receives directly from the lamps 105 lumens and absorbs only 30 lumens, while the floor receives 330 lumens from the lamps directly and absorbs 405. For convenience the values used in the last calcultions are arranged herewith in tabular form:

Location	Incident Lumens	Absorption Coefficient	Lumens Absorbed	Lumens Reflected	Lumens Received by Reflection	Lumens Supplied by Lamps
Ceiling.....	150	0.20	30	120	45	105
Floor.....	450	0.90	405	45	120	330
Totals..	...	....	435	...	...	435

An analysis of the above values shows some interesting relations. The sums of the fluxes absorbed by the two surfaces is equal to the sum of the fluxes sent to these surfaces from the lamps, but there is no immediate relation between the lumens directed toward each surface from the lamps and the lumens absorbed by that surface. For example, the lamps send 330 lumens to the floor, which absorbs 405 lumens from a total of 450 received by it. It is noteworthy in this connection that the familiar point-by-point method applied to the lighting installation here assumed would indicate an incident flux on the floor and ceiling of 330 and 105 respectively, whereas the true values are 450 and 150, the increase being due solely to the inter-reflection between the two surfaces. For the purpose of investigating such inter-reflection and of determining the amount of light which the lamps should produce on each surface the absorption-of-light method is highly advantageous.

An objection which may be urged against the absorption-of-light method is that it ignores any lack of uniformity in the distribution of illumination over the individual surfaces considered. Such a criticism is fully justified by the facts, but it has no bearing on the value of the method both as a check on other methods which take into account the variation in light distribution and as a direct final method to be used in problems where the variation in light density is of no importance. For purpose of comparison it may be likened to a method which would permit one to ascertain at once the required horse-power rating of a motor to drive a certain machine tool, but did not specify whether the motor should be a series-wound direct-current machine equipped with interpoles or an induction motor with a coil-wound secondary.

For solving problems connected with the illuminating of reflecting surfaces, investigating quantitatively the effect of inter-reflection between surfaces, and ascertaining the limits in the distribution of light flux between illuminated surfaces, the absorption-of-light method should prove of much value to the illuminating engineer.

NEW TELEPHONE PATENTS.

TRANSMITTING AND RECEIVING INSTRUMENTS.

It has heretofore been one object in the design of transmitters and receivers to avoid all natural vibrations and resonance, so that nothing would be present on the line but the forced vibrations due to the sound waves. Mr. V. Tardieu, of Arles, France, has worked upon an entirely different theory and to that end has designed his instruments to resonate. In Fig. 1 is shown a section of his transmitter. It will be noted that it has the general form of a tube of uniform diameter cut into sections by various transverse partitions.

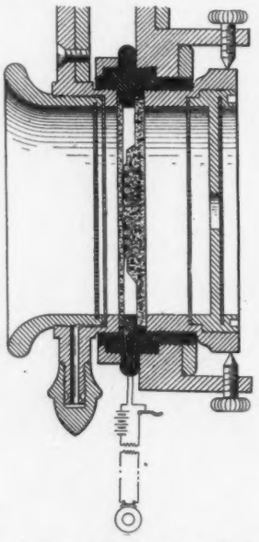


Fig. 1—Tardieu Resonating Transmitter.

First, at the left, is a perforated screen with a drain for catching moisture; next the main diaphragm. Then follow two carbon diaphragms serving as electrodes. Next there is a second metal diaphragm and the centrally perforated closing plate, covered by an external gauze. A pitch is selected as the fundamental upon which to base design representing the average pitch of the voice to be transmitted. The diameter of

the tube and the spacing of the above-mentioned transverse diaphragm are then made such as to cause responding resonances and interferences of high pitch. These latter are transmitted and received. The resonating cavities of the receiver, however, are so proportioned that the interference waves are substantially at the pitch of the original sound to which the transmitter is exposed. It is claimed that great efficiency of transmission is obtained from these instruments.

Another patent granted to the same inventor describes a transmitter mounting appliance.

A novelty in transmitter mouthpieces, apparently of considerable merit, is described in a patent issued to Mr. T. C. Rafferty, of Philadelphia. It is for use with instruments for the deaf. A thick button-shaped piece lies with its convex side out. This is provided with conical holes with their large ends out and their axes converging toward the center of the rear wall of the mouthpiece in front of the middle of the diaphragm. Sound from any direction will be picked up and conducted to the diaphragm.

The principle involved in the construction of flexible French curves, such as used in drawing, has been employed by W. H. Thompson, of Wheeling, W. Va., as a handle or connecting bar for the transmitter and receiver of a hand micro-telephone. It will be seen that each user can adjust the handle to fit his head.

Fig. 2 shows the construction of a receiver, the joint invention of Messrs. H. R. Stuart and E. O. Kizer, of Wheeling,

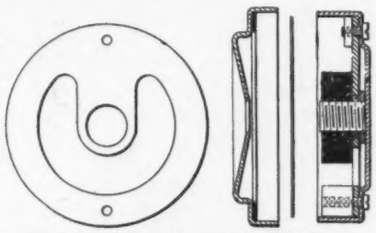


Fig. 2—Stuart and Kizer Receiver.

W. Va. The punching shown at the left is the polarized magnet, the tongue carrying one pole and the other lying opposite to it in the narrow ring portion. A pole piece is clamped to the ring at the pole and a central pole piece carries the bobbin. The latter is screwed down onto the threaded pole piece and serves as a lock nut when the latter has been adjusted to the proper height in the nut of magnetic metal. One terminal of the coil is a metal plate clamped between the bobbin and the magnet.

Mr. D. H. Wilson, of Chicago, has patented a system of ringing wherein a low-potential interrupted current in the primary of a set of induction coils is transformed and put out upon the line for ringing magneto bells. Four coils are used, and the circuits are controlled by a switch. When this is depressed for ringing, the vibrator is cut in, and the secondaries of the four coils are connected up in series. With the key released, the coils are connected to the telephone circuit, grouped two in parallel, two in series.

LETTER TO THE EDITOR.

Increasing the Permissible Output of Dynamo-Electric Machinery.

To the Editor of Electrical World:

SIR:—Judging from the results obtained, one is justified in assuming that the manufacturers have given less thought to the possibilities of increasing the permissible output of dynamo-electric machinery than they have applied to the similar problem relating to stationary transformers. In each type of apparatus the permissible output is limited by the maximum temperature at which it can operate without damaging the insulation, and hence any method which will result in lowering the operating temperature will permit the output to be increased. A striking example of the efficacy of methods that can be employed for this purpose is found in the enormous increase in rating of a transformer when artificially cooled over the same apparatus without means for decreasing the temperature rise under load.

Probably many years will elapse before all of the schemes now used for cooling stationary transformers will be applied to dynamo-electric machinery; although much has been accomplished along the line of forced air cooling, yet full benefit has seldom been obtained from this method. The placing of separators between the armature laminations at intervals ranging from 1 in. to 3 in. represents about all that some manufacturers have attempted in this direction. The writer believes that the manufacturers should provide such increased ventilating ducts throughout their machines and should arrange for forcing air under pressure through these ducts and all passageways. By placing commutating poles on all direct-current machines, sparking can be thoroughly eliminated so that the permissible output will be limited solely by the efficacy of the means used for cooling the apparatus. The customer who voices an objection to the artificial cooling of the machines on the ground of its indicating poor design or an unnecessary attempt to economize in material should have his attention called to the standard practice of to-day with the most satisfactory of all apparatus, namely, the artificially cooled stationary transformers.

Chicago, Ill. JAMES GRAY.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Three-Phase Series Commutator Motor.—L. DREYFUS AND F. HILLEBRAND.—The authors give, with the aid of diagrams, the theory of the three-phase series commutator motor with a series transformer inserted between the stator and the rotor. The authors show how it is possible to build a machine for high network voltages without an undue increase of the armature voltage at starting. They also show how the motor can be regulated by displacement of the brushes within wide speed limits and how it can be compensated by simultaneously changing the ratio of transformation. They finally show how the behavior of the motor may be influenced by an adjustment of the saturation of the iron of the transformer and how it is especially possible to fix a maximum speed. To confirm the theory a few experimental results are finally given.—*Elek. und Masch.* (Vienna), May 1.

Variable-Speed Induction Motors.—An illustrated article on variable-speed three-phase motors of the Oerlikon Company. They are now being built for five and six speeds, particularly for mining work. A description is given of a 100-hp induction motor which is built to run at 105 r.p.m., 360 r.p.m., 485 r.p.m., 725 r.p.m. and 970 r.p.m. and gives at these speeds 10 hp, 34 hp, 48 hp, 70 hp and 111 hp, respectively, on the spindle shaft. This motor is supplied with three-phase currents at 2200 volts between phases and a frequency of 50 cycles. The stator is equipped with three independent sets of drum windings, equally divided in the 144 slots. The first winding, for the lowest speed, has 48 poles. The two other windings are arranged for two sets of poles in the ratio of 1 to 2, namely, 16 and 8 poles and 12 and 6 poles, respectively. The first winding has 55 turns per slot, the second winding has 24 turns, and the third winding has 24 turns. The windings for the 16 and 8 poles are formed of eight sets of coils, and the windings of 12 and 6 poles are formed of six sets of coils, which are connected in series for the higher number of poles, and in parallel for the lower number of poles, as indicated in

Fig. 1. The pole change-over switch is of simple design. The contact pieces are so arranged on the controller drum that no crossing of the leads beneath the individual contact pieces takes place, so that the insulation of the individual contacts against the drum and between each other is perfect. There are 20 contact fingers in number, 17 of which are required for the pole-changing device and three for the leading-in wires. The contact drum is provided with a ratchet giving seven distinct positions, five of which correspond to the five different

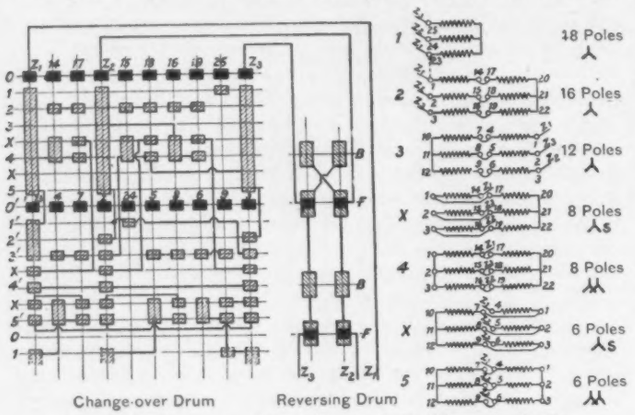


Fig. 1—Diagram of Connections of Oerlikon Controller.

speed steps, while the intermediate positions are so-called "transition positions" from 12 to 8 and from 8 to 6 poles. The pole change-over switch is equipped with a reversing drum, which moves freely on the shaft of the main drum, but so interlocked that it can only be operated when the main drum is in the zero position—that is, when the stator is disconnected. The whole change-over and reversing gear is oil-immersed.—Lond. *Electrician,* April 29.

Vertical Motors.—J. Fischer-Hinnen.—An article illustrated by diagrams. The chief difficulty in designing high-speed vertical motors is the construction of the bearings. The author discusses a number of typical bearing constructions and gives diagrams of several vertical direct-current and three-phase motors of latest design.—*Elek. und Masch.* (Vienna), April 24.

Leakage Reactance.—J. Rezelman.—The author supplements his recent article on "leakage reactance" with the test results of the reactance of a four-pole stator winding with special end connections. The results confirm his conclusions on the mutual induction between phases.—Lond. *Electrician,* April 29.

Leakage of Induction Motors.—M. Kloss.—An English translation of his recent German paper in which it is shown how the value of the leakage of the coil ends of a three-phase induction motor or alternator can be determined in a simple manner.—Lond. *Electrician,* April 29.

Cross-Section of Transformer Cores.—K. Schmidt.—A brief mathematical article showing that the rectangular cross-section is in general preferable to a circular cross-section for transformer cores.—*Elek. Zeit.,* May 5.

Iron Losses.—Niethammer.—In calculating the iron losses in slotted dynamo armatures it is not possible to employ the ordinary hysteresis and eddy-current coefficients. The author gives a summary of all of the fundamental formulas for the use of designers for calculating the iron losses in commercial machinery.—*Elek. und Masch.* (Vienna), April 17.

Iron Losses.—C. F. Guilbert.—An article on the measurement and calculation of the iron losses in a rotary elliptic field and in an oscillating single-phase field, with special reference to a recent German paper of Rother.—*La Lumière Elec.,* April 23.

Lamps and Lighting.

Tungsten Filament.—A note on a recent British patent (8781, 1909; April 28, 1910) of the British Thomson-Houston Company (General Electric Company of this country). A plastic mass containing tungsten is produced by precipitation from a solution of tungstate of ammonia or other alkaline compound and a cyclic hydrocarbon derivative, such as gallic acid. The precipitate can be squirted and a shrinkage in section of 75 per cent is said to be obtained, thus rendering possible the production of very fine filaments. Finely divided tungsten may be added to the mass previous to squirting; this makes it conductive and renders baking previous to sintering unnecessary.—Lond. *Elec. Eng'ing,* May 5.

Support for Metallic Filament.—A note on a recent British patent of H. J. Jaeger (26,006, 1909; April 28, 1910). An elastic anchor for supporting the filament at the bend of the loop consists of a metal wire support with a glass bead fused onto the end. The filament passes through the glass bead and does not come in contact with the wire. Volatilization of the wire is thus avoided, and the supports of the different loops may be twisted together. The glass may be in a fused condition during the operation of the lamp.—Lond. *Elec. Eng'ing,* May 5.

Rectifying Effect of Alternating-Current Lamps.—O. M. Corbino.—A paper on the thermic oscillations in lamps with thin filaments when operated by alternating current, and on the resulting rectifying effect due to the presence of higher harmonics of even order.—*Phys. Zeit.,* May 1.

Strength of Metallic Filaments.—T. Mueller.—An English translation of his recent German paper on a method of testing the mechanical strength of metallic filaments.—Lond. *Electrician,* April 29.

Generation, Transmission and Distribution.

Water-Power Stations in Sweden.—A. V. Clayton.—The conclusion of his paper on hydroelectric installations in Sweden. After a description of a number of typical horizontal-shaft turbine stations, the author refers to the use of vertical-shaft turbines and generators of the umbrella type, principally on very low falls. While according to American custom gearing is employed to increase the speed of the generators driven from slow-speed turbines, in Sweden direct-coupling is the rule. A class of turbine-generator set devised by Boeving consists of two wheels running in opposite directions, the shaft of one being hollow and having inside of it the shaft of the oppositely rotating turbine. To these two shafts are attached, respectively, the field structure and the inductor of the generator, both of which rotate, but in opposite directions. The result is that, for a given frequency and speed, the generator has only half the number of poles that would be required if the field alone rotated; in other words, it is equivalent to doubling the speed of the generator. Several of these have been at work at Hellefors for many years past, and are quite satisfactory. In vertical-shaft turbines the rotating parts must, of course, be suspended. Many unsuccessful attempts were made to take up this weight on ball bearings, but now it is almost general to use hydraulic bearings, which float the entire system where the weight to be supported is too great to be taken up on the ordinary lignum-vitæ turbine footstep. In a power station at Korsnas no less than four pairs of turbines—that is, eight wheels—are used on one shaft. The fall in this case is only 6 ft. and despite the use of eight wheels the speed is only 107 r.p.m. while the power is only 420 hp. Installations with such very low falls utilizing enormous quantities of water per horsepower developed are excessively costly compared with their rated output. Twin wheels are the ideal; however, in many cases quadruple wheels must be used to enable the use of large-size electrical generators at reasonably high speeds. On high falls the opposite obtains, and in such cases single wheels having high peripheral velocity are used in order to get reasonable speeds for the generators. A single-wheel turbine of this class, with an output of 3300 hp, is in operation on a 200-ft. fall at the works of the British Aluminum Company, at Stangfjorden, Norway. Even with this single wheel of large horse-power rating the speed is 300 r.p.m. and at this speed the generators, which are of continuous-current type, had to be divided into two units of 1100 kw each.—Lond. *Electrician,* April 29.

Energy Transmission in Spain.—Some notes on the new transmission plant of the Sociedad Hidroelectrica Espanola which, when completed, will have a rating of 30,000 hp. Energy is to be transmitted at from 66,000 volts to 70,000 volts from the Molinar station on the Jucar River to Madrid (the distance being 245 km, or 150 miles), Valencia, Cartagena and

Alcoy. At present three 7200-hp turbines have been installed, each being directly coupled to a 5625-kva, three-phase generator. The voltage is raised in three three-phase transformers to 67,000 volts for transmission. At present two transmission lines have been completed, one 245 km in length to Madrid with six wires, each of 50 sq. mm cross-section, and the other 80 km in length to Valencia with six wires, each of 35 sq. mm cross-section. The normal distance between poles is from 80 m to 100 m, and the distance between two adjacent wires is 1.8 m. A considerable part of the energy is to be transformed in converter substations to direct-current energy for traction. Energy will also be used to a large extent in mines and industrial works.—*Elek. Zeit.*, May 5.

Reversing Rolling Mills.—T. B. MACKENZIE.—An account of some observations made at a visit to the Hildegardehütte Works, which was the first electrically driven reversing rolling mill in Europe. He also gives comparative curves of the cost of compound-steam drive, all-electric drive, and turbo-electric drive. The curves show clearly that the larger the output, the better is the case for electricity. The great advantage of electric driving is that it is easy to ascertain exactly what power is required for each section rolled. Therefore, to ascertain the cost of rolling any section a good way would be to plot two diagrams; one would show the capital charges (abscissae being, say, tons per shift and ordinates rates per ton). A hyperbolic curve giving the capital charges for the whole with equipment drawn across the diagram, would enable the capital charges to be ascertained for the particular output wanted. The other diagram would have abscissae and ordinates as before, but in this case there would be drawn across the diagram a series of curves giving the product of kw-hours per ton into rate per kw-hour for energy. Then running up from the output to the appropriate energy curve the rate per ton would be read on the vertical scale. The sum of these and the wages charges per ton would show the cost of rolling that particular section. The author looks on the gas engine as the real solution of the chief motive-power problem.—Lond. *Electrician*, May 6.

Electricity in the Steel Industry.—D. S. BIGGE.—A paper read before the Iron and Steel Institute on the development and production of electric energy and its application and bearing upon the iron and steel industry. The author discusses recent developments in cheapening the cost of production of electric energy, particularly in connection with the iron and steel industries. Exhaust and mixed-pressure turbines are referred to in this connection, and the various types are described, together with particulars of the saving to be expected. He next passes on to gas engines and the use of blast-furnace or coke-oven gas, and finally refers to electric rolling mills and electric furnaces.—Lond. *Electrician*, May 6.

Tan Bark as a Boiler Fuel.—D. M. MYERS.—An account of an experimental investigation of the use of tan bark as a boiler fuel. Wet spent hemlock tan usually contains close to 65 per cent of moisture. Bomb calorimeter tests on many samples of spent hemlock tan give an average value of about 9500 lb-Fahr. heat units per pound, sample being dried before burning. The available heat per pound as fired after subtracting moisture loss is about 2665 units. As compared to coal of 13,500 heat units, 1 ton of hemlock bark is equivalent to 0.42 ton of coal. A considerable improvement in efficiency was produced by a specially designed furnace providing automatic feeding, large combustion space over the fuel, and special draft admission. The use of presses for reducing the moisture in the tan before firing may be good economy if the amount of tan compared to the amount of coal used is considerable, and providing the grate surface is properly reduced to meet the demands of the more rapid combustion. In practice the grate surface is sometimes reduced one-third on the introduction of tan presses. Under usual tan-burning conditions the total gain in available heat from the use of a press is about 1.12 per cent for each per cent drop of moisture content, and this drop rarely exceeds 7 per cent—that is, a reduction of moisture from, say, 65 to 58 per cent. The author is of the opinion that the combined boiler and furnace efficiency would rise considerably when tan presses are used, owing to increased furnace temperature and better combustion. Under usual working conditions the addition of coal to tan produces a decided increase in degree of combustion and a consequent rise of thermal efficiency. When wood is used as a supplementary fuel to tan and fired in the same furnace, the best results are obtained by first grinding the wood to the size known as "hog feed." The firing of wood in log or slab form is disastrous, both to the furnaces and to combustion. —*School of Mines Quarterly*, January.

Price of Electric Energy in Sweden.—In the discussion of Clayton's paper on Swedish water-power stations, the author gave the following information on the cost of electric energy in Sweden. The price per hp-year obtained in Sweden is a very variable quantity. In some cases it is as low as $6.90 and in others amounted to as much as $32.50. A fair average is $13.75. In contracts which were made for a number of years at $32.50 the supply of the full power demanded was guaranteed, but where the supply was not guaranteed the price was lower.—Lond. *Electrician*, April 29.

Traction.

Electric Tramways in Germany.—G. DETTMAR.—An article giving statistical data on electrical tramways in Germany in 1908. The total length of electrical tramways is 4118 km, the total rating of the generators, 143,822 kw; that of the storage batteries, 39,262 kw; the number of cars, 20,249; the capital invested, $272,903,000. The average interest earned on the capital invested is 4.34 per cent. The values of interest in different parts of Germany vary greatly; the interest is lowest in the Province of Eastern Prussia, namely, 2.29 per cent, and highest in Hamburg, namely, 8 per cent. The average interest earned by street railways not operated electrically is 3.19 per cent. The total number of annual car-km is 578,883,000, the total number of seats in the cars 622,635, the total number of passengers per year 2,103,119,000, the average number of passengers per kilometer 347,000, the average receipts per kilometer $9,000, the average cost of operation per kilometer $6,500, the average receipt per passenger 3.25 cents, and the average cost of operation per passenger 2.25 cents. About 82 per cent of the German street railways are operated electrically.—*Elek. Zeit.*, May 5.

Electromagnetic Railway Brake.—A note on a recent British patent (4171, 1910; April 28, 1910) of the Westinghouse Electric Company. Magnetic wheel or track brakes are provided with series and shunt windings. For ordinary service applications, the series winding is supplied with current from the motors acting as generators. If necessary, the shunt winding can be excited at the same time through a resistor directly from the trolley wire through one or more contacts on the controller. For emergency applications only the shunt winding is employed, but all resistance is cut out, so that the full trolley-wire voltage is applied to the winding.—Lond. *Elec. Eng'ing*, May 5.

Installations, Systems and Appliances.

Restricted-Hour Supply.—Some editorial notes on the annual report of Mr. P. J. Pringle, electrical engineer of the Burton-upon-Trent municipal central station. Notwithstanding that the output of kw-hours by the electricity department is practically the same as a year ago, and that the number of higher-priced units sold shows a considerable decrease, the surplus declared on the year's working is nearly double that of last year, and is the highest shown for many years. This result has been brought about by a reduction of no less than 27.6 per cent in the cost of fuel, due to important economies introduced in the boiler house. The revenue from private lighting is actually less than it was seven years ago, although the lamp connections have increased 47 per cent during that time. More satisfactory progress, however, is recorded as regards motor service. The Burton station is one of the few in Great Britain which have made a feature of restricted-hour supply. This system has been very successful. Eighty per cent of the total horse-power connected and 79 per cent of the total number of kw-hours sold for motors are used on the restricted-hour principle. This result seems to indicate that the consumption of energy per

horse-power installed is not appreciably diminished when the restricted-hour system is adopted. As the cost of generating the restricted-hour units is only about 35 per cent of the revenue obtained, these units must have had a very important effect on the financial success of the station during the last year or two. As Burton motor users are now obtaining energy on the restricted-hour system at an average price of 1.710 cents per kw-hour the advantages of the system are by no means confined to the station.—Lond. *Electrician,* May 6.

Protection Against Dangerous Rise of Voltage.—F. Schrottke.—The first part of a paper in which the author discusses the practical use of the protective condensers made by a Swiss company and of the electric valve of Giles. He thinks that they are rather dangerous instead of offering protection. In a discussion of the general problem of dangerous rises of voltages and of the influence of lightning storms on electric installations he shows that protection can be obtained by means of damping resistances, but not by condensers. The paper is to be concluded. (Just the opposite standpoint is taken in the paper noticed in the following abstract.)—*Elek. Zeit.,* May 5.

Protection of Networks Against Discharges and Dangerous Rises of Voltages.—Wohlleben and Giles.—The first part of a paper read before the Dresden Electrical Society giving general considerations on protective devices against dangerous rise of voltage. The authors conclude that any apparatus employing an ohmic resistance and any apparatus using a spark-gap is without practical value as a protective device. On the other hand, they claim that protection can be obtained by means of a condenser. The paper is to be concluded.—*Elek. Zeit.,* May 5.

Electricity and Coal-Dust Explosions.—W. M. Thornton and E. Bowden.—An abstract of a paper read before the North of England Institute of Mining and Mechanical Engineers. The conclusions are as follows: "Coal-dust, although an insulator when dry, becomes a conductor if wet enough for carbonization to take place. The necessity for keeping commutators clean, especially the small gap between live copper and the frame, is obvious. There appears to be no danger of flashing-over on 480 volts between live parts 1.25 in. apart unless the deposit of dust is entirely conducting as from carbon brushes. Distributing boxes should be dust-tight and flame-tight, and should be in compartments so arranged that the main terminals cannot be short-circuited by a flash. Cartridge fuses should always be used where possible. Momentary arcs produced by break of cables or conductors can ignite dust; however, the current required to do so is very much greater when the voltage is low, and at moderate voltages is greater for alternating than for direct current. This fact suggests that the arrangement most satisfactory from the point of view of safety, both for flashes and for shocks, is high-tension transmission to a substation or transformer house, probably with cables well enough armored to prevent any external flash, and quite low-tension local transmission for motor service and lighting. Series lighting with incandescent lamps is not to be recommended. Although it has been shown that a cloud of coal-dust can be ignited by small single flashes, and the degree of probability has been found for most cases likely to occur in practice, does not follow that the use of electricity in collieries is dangerous. Electricity is no more dangerous than the supply for domestic use of highly poisonous and explosive coal-gas. An efficient leakage indicator is equally necessary for both. No indicator will prevent risk from sudden breakage of either pipes or cables; in the electrical case there is the advantage that the main supply can, if desired, be cut off by a small leakage current.—Lond. *Elec. Eng'ing,* May 5.

Automatic Protective Switchgear for Colliery Service.—E. B. Wedmore.—The author discusses the arrangement of trip coils and the discriminating action of automatic leakage devices in mines. He also refers to armoring and the earthing of the neutral point of three-phase generating plant:—Lond. *Electrician,* May 6.

Electrical Industries in The United States and Germany.—W. Fellenberg.—The conclusion of his long statistical article on the development of the electrical industries in the United States and in Germany. The author compares the electrical industry with the iron and steel industry of the United States. He further compares the German and American electrical industries and then discusses electrical exports. Finally the progress in reducing the cost of products of electrical industries of the last 50 years is discussed and data are given on the different raw materials used in electrical industries.—*Elek. Zeit.,* May 5.

Canala.—J. Dalemont.—A statistical review of the electrical industries of Canada.—*Revue Economique Internationale,* December, 1909; *Elek. Zeit.,* May 5.

Electricity in Mines.—Illustrated articles on electricity in colliery-sinking operations and on electrically driven mine fans, notes on special cables for use in mines, and a description of the Siemens mines signaling apparatus.—Lond. *Elec. Rev.,* May 6.

Electrophysics and Magnetism.

Electricity of Rain and Snow.—G. C. Simpson.—An account of results of measurement of the electric charges carried down by rain and snow during the winter of 1908-1909. Snow carries down more positive electricity than negative electricity, the ratio of the two quantities being about 3.6:1. The snow which falls is more frequently charged positively than negatively. The vertical electric currents are in general stronger during snowfalls than during rain. The charge per unit of mass is greater for snow than for rain.—*Phys. Zeit.,* May 1.

Canal Rays.—An article by W. Wien on the presence of positive and negative ions in the canal rays of hydrogen, oxygen and nitrogen, and a paper by J. Koenigsberger on the temperature of canal rays when emitting light.—*Phys. Zeit.,* May 1.

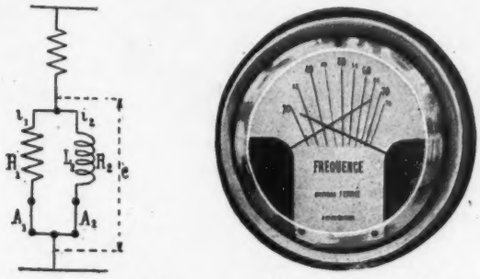
Positive Electricity.—D. Owen.—A review of recent researches on the existence of a positive unit of electricity.—Lond. *Electrician,* May 6.

Magnetic Properties of Manganese, Vanadium, and Chromium.—Pierre Weiss and K. Onnes.—An abstract of a French Academy paper. It has often been asked whether there is an essential difference between the properties of ferromagnetic and paramagnetic materials or whether it would be sufficient to lower sufficiently the temperature of the latter in order to put the ferromagnetism into appearance. By cooling manganese, vanadium, and chromium to the temperature of liquid hydrogen, it was expected either to note the appearance of ferromagnetic phenomena (non-proportionality of induction and magnetization current, saturation and hysteresis) or a paramagnetism considerably increased according to the law of Curie. According to this law susceptibility should be about 20 times as large as the temperature of liquid hydrogen as at ordinary temperature. However, neither one nor the other result was found by experiment. The magnetic phenomena remained very feeble. On the other hand, the authors found at a low temperature an enormous increase of the magnetic properties of a little crystal of iron sulphate. Ferromagnetism has, therefore, not appeared and it became necessary to make a choice for these materials between two hypotheses; either paramagnetism of a new type, not obeying the law of Curie, or diamagnetism. In a research of Du Bois and Houda it was shown that the former hypothesis is correct. According to the second hypothesis suggested by the example of diamagnetic copper the salts of which are paramagnetic, the apparent paramagnetism of manganese would be due to impurities or oxide. The authors have prepared pure manganese by decomposing the pure amalgam in a current of hydrogen. This manganese powder is paramagnetic, but when it is melted in an electric resistance furnace in a magnesia crucible and in an atmosphere of hydrogen it becomes ferromagnetic. The magnetic manganese has also been discovered by Seckelson.—*L'Industrie Elec.,* April 25.

Units, Measurements and Instruments.

Double-Needle Instruments; Frequency Meter; Ohmmeter.—J. Reyval.—A description of a general type of double-needle instruments devised by Ferrie and Carpentier. Each instrument is really a combination of two instruments, each of which has its own needle. The points around which the two needles

rotate are not the same. It is then evident that if a certain quantity (electric or not) is a function of two other quantities which are measured by the deflections of the two needles, then the third quantity can be measured by the displacement of the point of intersection of the two needles provided that once for all the common dial has been calibrated. The application of this principle to a frequency meter is indicated in Fig. 2, where



Figs. 2 and 3—Frequency Meter and Connections.

R_1 is a non-inductive resistance and L_2 is an inductance with a very low resistance. A_1 and A_2 are two ammeters measuring the currents i_1 and i_2 of the two branches. Now the frequency is approximately proportional to the ratio of i_1 to i_2. Hence the point of intersection of the two needles of the ammeters will give directly the frequency if the instrument is properly calibrated. The instrument is shown in Fig. 3. The ammeters used are hot-wire milliammeters. (See also the abstract of the article by Ferrie under Telegraphy and Telephony.) In the same way an ohmmeter may be constructed from a combination of voltmeter and ammeter.—*La Lumière Elec.*, April 30.

Determining the Power of Alternating Currents from Oscillographs.—E. BEHNE.—The author describes a simple graphical method for determining the power of an alternating current from the simultaneous curves of current and voltage. The method is based on the use of polar co-ordinates. A numerical example is added.—*Elek. und Masch.* (Vienna), May 1.

Mica Tubes.—K. FISCHER.—An English translation of his recent German paper in which comparative tests were given showing the superiority of a new type of mica tube containing no paper and practically no binding material. Such tubes, being of mica alone, give very high electric disruptive results.—Lond. *Electrician*, May 6.

Meter.—An official communication by the Reichsanstalt admitting for calibration a direct-current magnet-motor meter of the Allg. Elek. Ges. Its construction and method of operation and calibration are described.—*Elek. Zeit.*, May 5.

Exhibition of Instruments.—J. REYVAL.—The first part of an illustrated description of the various instruments shown at the recent exposition of the French Physical Society in Paris.—*La Lumière Elec.*, April 30.

Telegraphy, Telephony and Signals.

Telephone Relay.—S. G. BROWN.—A paper read before the (Brit.) Inst. Elec. Eng. The author describes the present form of his telephone relay, which depends on the variation in resistance of a microscopic air-gap. It takes as its basis the researches of J. J. Thomson, Earhart, Kingsley and others with regard to the flow of electrons across a microscopic air-gap between two conducting surfaces at different potentials. Earhart made a series of experiments on the difference of potential required to produce a spark the length of which is comparable with the wave-length of sodium light, and found that when the distance between the metal electrodes falls to less than about 0.0003 cm the spark potential falls off rapidly with the distance and seems to become proportional to the distance; that is to say, when the electrodes are placed very close together, within a distance such that the average intensity of force F between the electrodes reaches a value of about 1,000,000 volts per centimeter, the discharge or current passing is determined by the condition that F, which is V/d, reaches this value (where V is the potential difference and d the distance between electrodes). If the metallic circuit of a dry cell is interrupted by a minute opening or space of the order of 0.000,000,5 cm, the metal at the point of interruption being platinum, the current will continue through the circuit and across the opening, and any slight alteration in the length of the space, which is called the conduction space, will vary its resistance and greatly affect the value of the current through the circuit. This conduction space is, therefore, exactly what is wanted for the current-varying device of a telephone relay, where microscopic mechanical movements are to be transformed into large current changes. The dimensions of the conduction space are so small that it is difficult to ensure and maintain it by direct mechanical means. The current across the space was, therefore, made to do its own adjustment, very much in the same way as the current through the arc of an arc lamp is made to strike and maintain the length of the arc. Fig. 4 is a side view of the instrument with

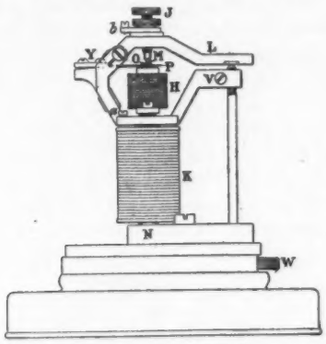


Fig. 4—Diagram of Telephone Relay.

the brass cover removed. N is a permanent magnet, continued by the soft-iron poles close up to, but not touching the "invar" steel reed P. Round the soft-iron pole extensions are wound the two sets of coil windings H and K. The telephone currents to be magnified circulate round the winding H and thus by varying the magnetism set the reed P in vibration. MO are the top and bottom metallic contact pieces, which are opened to an infinitesimal degree to form a microphone by the fine adjusting screw W and by the action of the local current passing through the contact and round the winding K. It is by the action of the local current operating through this winding that the conduction space is formed and afterward maintained. So good is the automatic adjustment that the instrument may be turned upside down, producing hardly any noticeable alteration in the value of the local current and without any effect on the working of the relay. The regulating winding K must not act when traversed by the rapidly varying telephonic currents; this result is accomplished by surrounding the iron under the coil by a closed-circuit copper sheathing. Eddy currents set up in this sheathing by mutual induction destroy the self-induction of the coil. This relay increases the very feeblest current to about 20 times the former value. The author also describes an electric stethoscope which promises to lead to important developments in medical practice.—Lond. *Electrician*, May 6.

Wireless Telegraphy Wavemeter.—G. FERRIE.—A brief review is given of the various methods that have been tried to obtain security in wireless telegraphy. A description is given of a simple wavemeter, due to the author, which enables measurements to be made without any adjustments from a simple

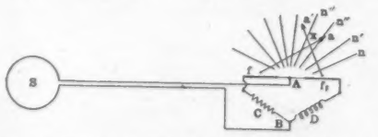


Fig. 5—Wireless Telegraphy Wave Meter.

reading. The principle is as follows: Between two points A and B (see Fig. 5) a certain effective e.m.f. (V) is maintained by means of a single loop S which encloses a part of the flux to be measured. Between A and B two circuits fC and f_1D are connected, each containing one wire (f and f_1) of a hot-wire ammeter and an impedance (C and D). Each of the wires f, f_1

controls a pointer (a and a'); these pointers are both capable of movement across the same scale. The currents through each of the wires are given with sufficient approximation for the case of damped waves by the formula

$$I = V/(R^2 + \omega^2 L^2)^{\frac{1}{2}};\ I_1 = V/(R^2 + \omega^2 L_1^2),$$

whence $I/I_1 = f(L)$. For each value of ω the pointers cross at some point on a curve which can be empirically marked on the scale. The apparatus having been previously graduated, the measurements of the wave-length or frequency of an oscillating circuit is made by simply taking a reading of the point of intersection while the loop S is held near to the circuit. The calculation of damping is also considered. (See also the abstract on Double-Needle Instruments under Units, Measurements and Instruments.)—Lond. *Electrician*, May 6.

Telegraph Cables.—A. Tobler.—A report of a visit to the cable station of Emden and on measurements of the new cable from Emden to Teneriffa. With all the Emden cables the automatic transmitter of Muirhead is used.—*Zeit. f. Schwachstromtech.*, Nos. 1 and 2, 1910; briefly abstracted in *Elek. und Masch.* (Vienna), May 1.

Propagation of Telegraph and Telephone Currents.—Examination questions, prepared by J. A. Fleming in connection with his postgraduate lectures at the University College, in London, on the propagation of electric currents in telegraph and telephone cables, unloaded and loaded. The solutions of the problems are also given.—Lond. *Electrician*, May 6.

Miscellaneous.

Electricity in Field Engineering.—R. E. B. Crompton.—A lecture delivered before the Royal Engineers' Institute in Chatham on army signaling, telephony in the field and wireless telegraphy. The author deals at considerable length with the use of search lanterns in the field.—Lond. *Electrician*, May 6.

Book Review.

The Engineering Index Annual. Eighth Edition. Compiled by the *Engineering Magazine*. New York: Engineering Magazine. 471 pages. Price, $2.

The present volume of this index is quite up to the excellent standard set by the previous volumes. The editors claim that the classified index system has met with all the success that was expected of it. There is much to be said, both for and against the system of indexing employed. The principle difficulty is in the classification itself. It is no easy matter to determine whether some subjects properly belong in mechanical engineering or electrical engineering and different people will render different decisions. The various branches of engineering overlap at so many points that it is necessary to index certain subjects under two or more heads. The difficulty involved in placing a subject under its main head is nothing compared with that encountered when determining the subclass. A classified index is excellent for the person who makes the index and also for those users who are familiar with the classification scheme used, but for the average person it is doubtful if it is better, or even as good as the straight alphabetical index, in which entries are made under all possible heads. Nevertheless, it is evident that the classified indexing system, due to the greater flexibility of this arrangement, will some day displace the alphabetical system in all extensive work. Therefore, it is highly important to develop a logical classification, if such be possible, and then take steps to make it standard, just as is being attempted with the Dewey system, which, however, is sadly illogical as far as engineering is concerned. The present index, improving as it does from year to year, should do much toward developing the desired standard.

New Apparatus and Appliances

FLAMING ARC LAMPS OF REMARKABLE BRILLIANCY

The first installation in the Northwest of 18-amp flaming-arc lamps was made in front of the National Guard Armory at Minneapolis, for service during the first annual electrical show held by the Northwestern Electrical Association, March 26 to April 2, 1910. One of the difficult problems to be solved by the association was the illumination of the exterior of the armory and its grounds. After giving the matter due consideration as to the best methods of illumination, it was unanimously decided to install the new 18-amp flame-arc lamp manufactured by the General Electric Company.

As an experiment, two of these lamps were placed at the top of a 50-ft. pole, approximately 75 ft. in front of the armory. Much to the surprise of those interested, these two lamps not only gave a brilliant golden light, sufficient to illuminate the entire building and street in front, but proved to be the best possible advertisement for the electrical show. As the lamps swung high in the air they resembled two miniature suns, at-

Fig. 1—Flaming Arc Lamp.

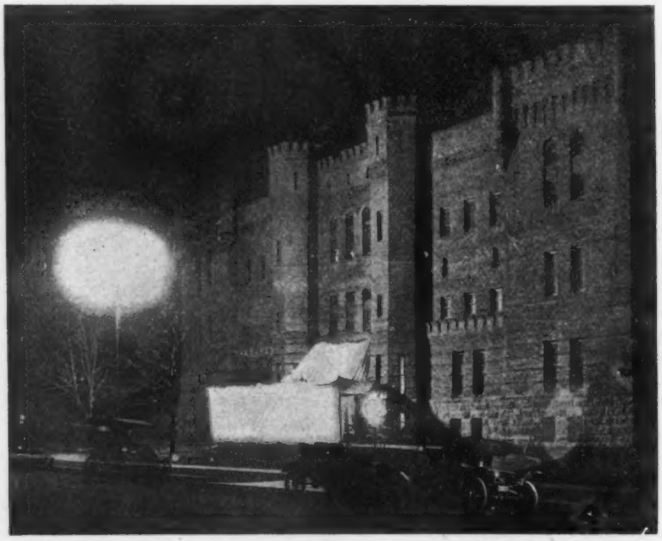


Fig. 2—Illumination of Exterior of Armory at Minneapolis.

tracting considerable attention for a great distance in all directions.

These 18-amp lamps are similar in construction to the well-known 12-amp lamps, but a slight change in the mechanism being required to adjust the lamps for operation at 18 amp. The accompanying photograph, taken at 9:30 p. m., gives but a faint idea of the remarkable brilliancy of the lamp.

SHOCK ABSORBER AND CORD ADJUSTER.

Whatever may be the final development of the metallic-filament lamp, it is without doubt true that at the present time it is a fragile proposition. The filaments will not withstand rough handling and when subjected to severe jars or shocks break. Were it not for this fact the remarkable efficiency of the lamps would cause them to be universally adopted in mills, factories, residences, etc. It appears that in mills and factories where the lamp is suspended by a cord from the ceiling, and where the ceiling acts as a floor and is subjected to jars and shocks caused by dropping heavy masses of material, breakage of the filament results in many cases despite the flexibility of the cord. The obvious way of relieving these sudden jars is by means of an

Shock Absorber and Cord, Adjuster.

absorber which will translate the sudden jar into an easy spring. The shock absorber illustrated herewith is manufactured by the Condit Electrical Manufacturing Company, of Boston, Mass., and possesses in addition a cord-adjusting feature. The device consists of a piece of flexible non-rusting wire, coiled into a spiral with extended arms, the end of each arm being formed into a U-shaped loop. The arms are crossed so that the spring is under compression and not under tension and the U-shaped loop in the end permits the adjustment of the lamp cord. The device, while simple, is claimed to be very efficient and remarkably springy. It can be readily applied on present installations without the necessity of changing any of the electrical features. It is supplied in two forms, one with an insulated end for use with new code reinforced cord, and the other with insulated ends for use with old code cord.

ELECTRICAL EXHIBITS AT SOUTHWESTERN CONVENTION.

At the sixth annual convention of the Southwestern Gas & Electrical Association, at Beaumont, Tex., May 12 to 14, a number of manufacturers and dealers in appliances and supplies pertinent to the needs of the industries represented, occupied exhibit booths in the Kyle Opera House Building, where the convention sessions were held. Among the electrical exhibitors were the following companies, with their representatives present:

American Car Company, St. Louis, Mo., Edward Bronenkamp, car seats, fare boxes, etc.; Atlas Railway Supply Company, Chicago, Ill., J. G. McMichael, rail bonds; C-A Wood Preserver Company, Austin, Tex., H. F. Gerhardt, wood preservatives; Crocker-Wheeler Company, Ampere, N. J., T. C. R. Spence, B. A. Schroeder, photographs of large machinery installations; Chicago Fuse Wire & Manufacturing Company, Chicago, fuses and fuse blocks; Duncan Electric Manufacturing Company, Lafayette, Ind., C. M. Welsh, meters and transformers; Electric Appliance Company, Dallas, Tex., and New Orleans, La., booth; Electric Traction Supply Company, St. Louis, Mo., O. R. Uthoff, fenders, fare boxes, registers and couplers; Electric Service Supplies Company, St. Louis, Mo., W. P. Hall, insulators, pins, bonds, lamp guards, lightning arresters and cut-outs; Goldschmit Thermit Company, New York, N. Y., Henry S. Mann, rail, pipe and solid section welding appliances and materials, foundry cans, etc.; Hobson Electric Company, Dallas and Houston, Tex., electrical apparatus, switchboards, etc., C. W. Hobson, M. F. Sturett, F. Bland and L. H. Johnson; W. N. Matthews & Brother, St. Louis, Mo., W. L. Crawford, guy anchors and lamp guards; Moloney Electric Company, St. Louis, Mo., J. J. Mullen, transformers; Tel-Electric Company, Houston, Tex., M. B. Wheeler, A. J. Binz, F. C. R. Spence, L. H. Fuller, G. E. Klise, Edw. Haile and C. George, fans, heating appliances, motors and supplies; Texas Electric Sign Company, Beaumont, Tex., C. J. Lewin, electric signs; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., H. B. Chamberlin, J. R. Cox, A. Ashley, L. Jolesby and G. W. Foote, transformers, meters, fans, heating appliances, etc.; Wagner Electric Manufacturing Company, St. Louis, Mo., J. A. Gelzer, motors, transformers, etc.; Westinghouse Machine Company, Pittsburgh, Pa., A. B. Johnson, photographs of steam turbines, gas engines and producer plants; Western Electric Company, Chicago, Ill., U. S. Arnold, R. D. Cummings, J. C. Mow, W. J. Thompson and Paul Joyslin, fans and telephones; Weston Electrical Instrument Company, Newark, N. J., meters; Wheeler Condenser & Engineering Company, Carteret, N. J., Harry Pennington, Houston, Tex., condensers and pumps.

Other electrical companies having representatives at the convention, but making no exhibit, were the following: American Diesel Engine Company, St. Louis, Mo., G. E. D. Fouge; Allis-Chalmers Company, Milwaukee, Wis., W. H. Yates, H. R. Sewell and F. G. Bolles; American Circular Loom Company, Chicago, Ill., G. C. Richards; Buckeye Electric Company, Dallas, Tex., J. Lee Norman; Columbia Incandescent Lamp Company, Dallas, Tex., C. L. Martin and H. S. Wescott; Dickson Car Wheel Company, Houston, Tex., G. C. Dickson; *Electrical World*, New York, O. H. Caldwell; Federal Electric Company, Kansas City, Mo., J. H. Bailey; Fort Wayne Electric Company, St. Louis, Mo., W. C. Knight and W. F. Cheslin; General Electric Company, Schenectady, N. Y., S. Harvey, J. W. Thorne, O. A. Jennings and H. W. Kilkenny; General Incandescent Light Company, Cleveland, Ohio, H. C. Rice and W. S. McFarland; Houston Armature Company, Houston, Tex., F. E. Ward; H. W. Johns-Manville Company, Dallas, Tex., Ed. A. Paetschow and R. B. Antry; Ingersoll, Rand Company of Texas, Houston, L. A. Wyman; Ohio Brass Company, Chicago, F. L. Cook; National Lead Company, St. Louis, Mo., L. L. Hopper; Pay-As-You-Enter Car Corporation, New York, David Murdock; Harry Pennington Company, Houston, Tex., H. Pennington; *Refrigeration and Electricity*, Dallas, Tex., J. B. McCrow; St. Louis Car Wheel Company, St. Louis, Mo., F. O. Grayson; *Southwestern Electrician*, Houston, Tex., C. A. Newning, J. C. Dionne, W. D. Dumont and J. G. Dillon; Standard Underground Cable Company, St. Louis, Mo., E. J. Pirtzker; Texas Machinery Supply Company, Houston, Tex., W. C. Woodlief and W. R. Collars; Tungstolier Company, Dallas, Tex., M. G. Whitman; Wesco Supply Company, St. Louis, Mo., T. H. Harris, R. A. Warfield and W. C. McIlheran; Westinghouse Air Brake Company, Dallas, Tex., C. P. Cass.

A BALANCED ROTARY ENGINE.

Mr. Gerardus P. Herrick and a number of his friends gave a dinner at the Waldorf-Astoria Hotel Saturday evening, May 21, at which was announced the discovery of a principle that it was claimed would render practicable the construction of large rotary engines, and thus introduce a prime mover which would command the field lying between the reciprocating engine and the turbine.

A 20-hp engine of this new design, which had been tested at Stevens Institute laboratory, and run for several months to drive a generator at the Degnen Contracting Company's plant, was exhibited at the dinner.

The dinner was presided over by Mr. Elias J. Herrick and short speeches were made by Messrs. Everett Colby, G. P. Herrick, F. L. Pryor, F. L. Stevenson and L. D. Lovekin. Professor Pryor, who had conducted the tests, said that he believed that Mr. Herrick had produced a commercial rotary engine. Mr. L. D. Lovekin, chief engineer of the New York Shipbuilding Company, stated that in his opinion a successful rotary engine would make possible and desirable the utilization of extremely high steam pressure. He suggested that a combination of rotary engine and steam turbines could be used to advantage with an initial steam pressure of several hundred pounds. The rotary engine would act as a reducing valve and exhaust at 140 lb. or 150 lb. per square inch into the steam turbines.

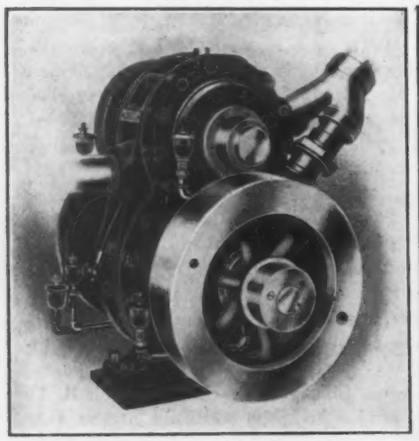


Fig. 1—Balanced Rotary Engine.

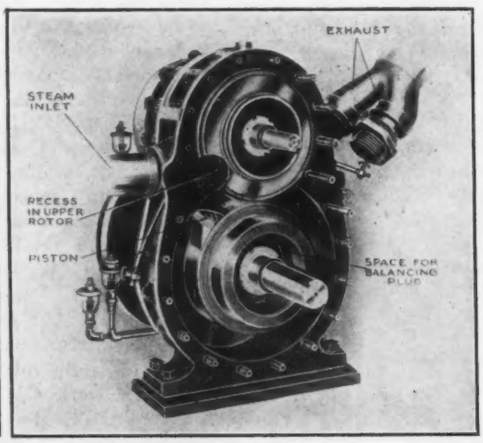


Fig. 2—Engine with Side Plate Removed, Showing Piston at Cut-Off.

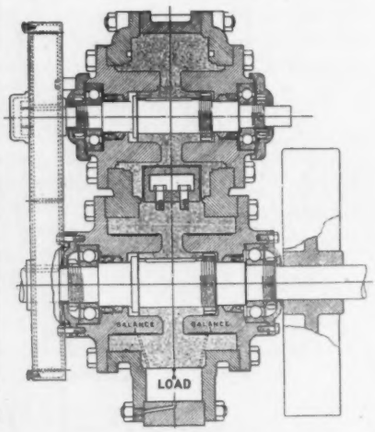


Fig. 3—Cross-Section of Rotary Engine.

The distinguishing feature of the Herrick rotary engine is the method of balancing the radial thrust, due to concentrated load on the rotary. The principle of the engine itself is old.

The engine consists essentially of two rotors of the same diameter and in rolling contact with each other, one of which carries a projection fitting closely in a casing and registering with a notch in the other rotor. The projection on the lower rotor provides the working surface which corresponds to the piston in the reciprocating engine. When this projection passes through the point of contact with the upper rotor, the notch in the upper rotor uncovers the steam inlet back of the projection and admits a given amount of steam in the space between the contact line of the two rotors and the projection. After cut-off this steam expands and pushes the lower rotor around until the exhaust port is reached, where the steam leaves the engine.

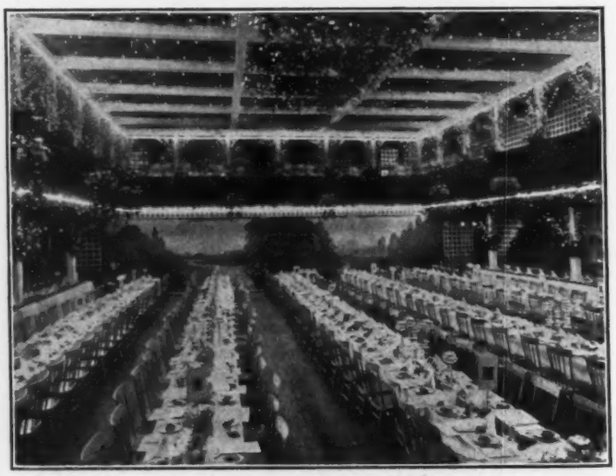
The balancing is accomplished by the use of specially constructed flanged plug on each side of the rotor, as shown in Fig. 3. This plug contains a number of shallow recesses in the surface presented to the under side of the working rotor, into which steam under pressure is admitted in such a way as to act in opposition to the working pressure, and in proportion thereto at all times. The result claimed is that the load, instead of being carried on a metallic surface, is sustained by a film of steam, the friction being that between steam and metal, rather than that between metals.

Tests on this engine showed a steam consumption of about 50 lb. per b.hp-hour, with a steam pressure of 145 lb. per square inch and atmospheric exhaust. With a steam pressure of 115 lb. per square inch and 18.4 in. vacuum, the engine required about 44 lb. of steam per b.hp-hour. The Herrick Engine Company has built a 100-hp engine, which is now installed in the laboratory of the Stevens Institute of Technology, tests of which will be available in the near future.

MOORE TUBES AT TAFT BANQUET IN PASSAIC, N. J.

The Board of Trade of Passaic, N. J., tendered on Monday evening, May 9, 1910, a dinner to President William H. Taft, and took special pains in the decoration and illumination of the banquet hall. In the hall of the Passaic Turn Verein false framework was constructed to produce the effect of an Italian pergola, which was festooned with branches of artificial apple blossoms, while shrubbery and evergreens were tastefully distributed in every nook and corner.

For the illumination two Moore tubes were utilized, each installed in rectangular form around the room. The tubes were each 162 ft. in length and 1¾ in. in diameter, of clear glass. The gaseous conductor utilized was nitrogen, producing a rose-yellow color of light. The tubes were operated on 60 cycles, 220 volts alternating current from the city service. Each tube consumed about 3000 watts and operated at a brilliancy of 18 hefners per foot. The speakers could see plainly the features of those in the rear of the room owing to the light being well diffused and without glare. The accompanying illustration, taken with the light, gives a view of the banquet hall.



View of Banquet Hall, Passaic.

BELL-RINGING TRANSFORMERS.

The use of bell-ringing transformers as a substitute for batteries is constantly increasing, and for all classes of light signal work are displacing the primary battery. While its

Fig. 1—Bell Ringing Transformer.

initial cost is higher, it requires no attention when once installed, whereas the battery requires frequent renewal and is usually out of order at times when most needed. The accompanying illustrations show a bell-ringing transformer manufactured by the Hartman Electrical Manufacturing Company, of Mansfield, Ohio. It is made in two sizes, one being designed to give 6 volts with 110 volts primary, which size is suitable for house bells, buzzers, etc., and will ring three or four bells up to 3-in. in diameter. The other type is intended for heavier work

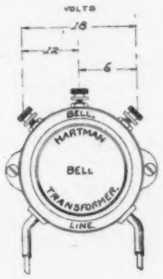
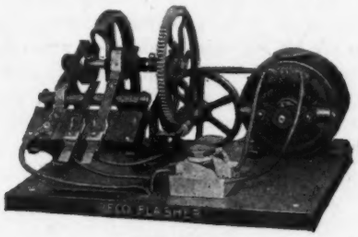


Fig. 2—Bell Ringing Transformer.

and has a very large output. Taps are brought out of the low-tension winding to give 6 volts, 12 volts or 18 volts, so that several circuits can be run from one transformer to secure the proper voltage for different work. Conforming to approved practice, the primary leads are brought through porcelain bushings instead of terminating at binding posts, as is frequently the case. These transformers will operate on the ordinary alternating-current lighting circuit at the usual frequency.

ELECTRIC SIGN FLASHER.

The Reynolds Electric Flasher Manufacturing Company, of Chicago, has recently placed on the market a sign flasher driven by a motor which is intended as a substitute for the automatic or thermo types of flashers. It is compact in form,



Sign Flasher.

with a machine-cut worm drive and gear. The contacts are of brass and heavy laminated copper brushes are employed. The motor and all mechanism are mounted on a single slate base, wired and ready to install.

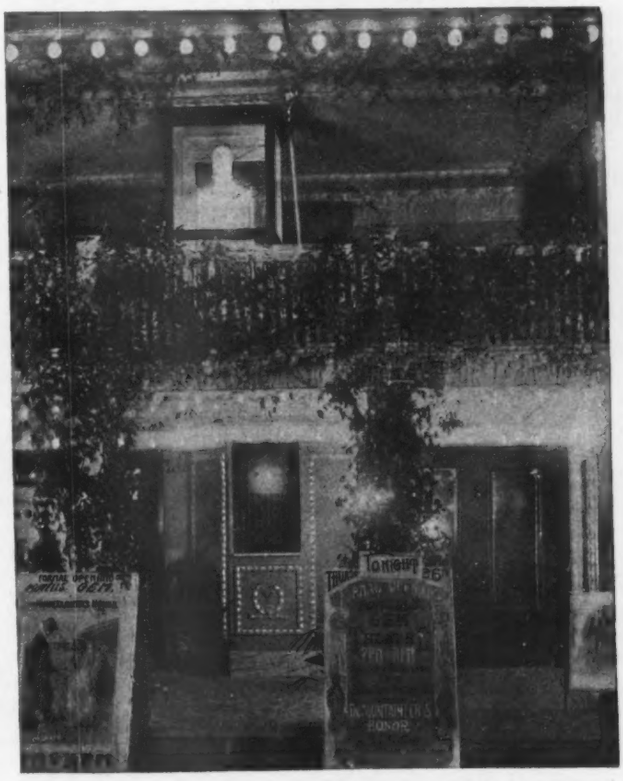
GIROD ELECTRIC FURNACE INSTALLATION.

The Simonds Manufacturing Company, of Fitchburg, Mass., with branch factories at Chicago, Ill., and Montreal, Canada, makers of the well-known "Simonds" line of saws and machine knives, is installing in the crucible steel department of its Chicago plant a Girod electric furnace, which is probably the first of this type to be built in this country, although many of these furnaces are in every-day successful operation abroad, these ranging in size from 2 tons to 12½ tons capacity each.

The experimental plant of the Simonds company is of special interest just at this time, as that concern has just acquired a tract of 60-odd acres of land at Lockport, N. Y., with excellent railroad and canal connections and ample electric power from Niagara Falls, which will make desirable and practical the melting of at least a portion of its steel by electric furnaces. Provision is being made at Lockport for the installation of more electric furnaces of a larger size than the one which they are now building, should expectations of the success of the experimental Girod furnace be realized.

A CLEVER ADVERTISING SCHEME.

Oklahoma is so imbued with the spirit of progress and advancement along every outlet for human activity, one is not surprised to unearth in the capital of that Southwest State an ingenious advertising scheme for moving-picture theaters. Manager B. H. Powell, of the Olympic Amusement Company,



Exterior View of Gem Theatre.

which controls a syndicate of houses in Oklahoma City, has not only taken advantage of the current-saving and light-improving qualities of the mercury-arc rectifier, but has utilized its advertising possibilities as well. The illustration is an exterior view of the Gem Theater, one of the Olympic houses, showing a General Electric rectifier outside on the balcony, where the brilliant bluish light can be seen by passersby for a long distance. The apparatus proved so successful in attracting attention that all the theaters in Oklahoma City are now using rectifiers in this manner.

Exhibits at the N. E. L. A. Convention.

THE exhibits at the thirty-third convention of the National Electric Light Association, held in the Coliseum Building at Washington and Jefferson Avenues, St. Louis, May 23-27, occupy the main floor of the immense structure, the stage being curtained off for use as the principal convention hall. The interior of the building is tastefully decorated in gold and white, and handsome chandeliers and star-shaped clusters of tungsten lamps, suspended from the draped ceiling, furnish the illumination. The booths are marked off by white columns of dignified design, each surmounted by a decorative art-glass shade enclosing a tungsten lamp. Suitable markers are provided for identifying the exhibitors, and the exhibits themselves, while not strikingly novel, are sufficiently diversified to attract the interest of central-station men. Material for distribution circuits, such as meters, transformers, protective devices, insulators, specialties for overhead and underground work, etc., make up the major part of the display. Incandescent and arc lamps are, of course, also in evidence, while motors and electric vehicles are large enough not to be hidden. Short descriptions of the exhibits follow in alphabetical arrangement.

Frank Adam Electric Company, St. Louis, Mo., manufacturer of switchboards, knife switches, panel boards and cabinets has on exhibition various types of panel boards and switches and a complete switchboard. The company's representatives are Messrs. F. B. Adam and A. C. Brandt

Allis-Chalmers Company occupies a large and prominent space containing much of interest. A model of a steam turbine gives those who are contemplating the installation of this type of apparatus a chance to familiarize themselves with its construction. Two shunt-wound motors and two induction motors show the features embodied in their respective designs. Three different sizes of transformers with 5 per cent and 10 per cent taps are on exhibition and suggest a satisfactory method of overcoming voltage drop on lines. A new type of oil switch, made both automatic and non-automatic, is exhibited by the company for the first time. A feature of these switches is the convenient means provided for removing the switch proper for inspection or adjustment. After the cover is removed, the switch can be lifted out bodily without the use of any tools to remove screws or to loosen connections. A motor-control switch and a remote-control switch are also shown. Included in the representatives of the company are the following: Messrs. A. H. Whiteside, J. R. Jeffrey, F. L. Bunton, J. W. Gardner, E. T. Pardee, F. C. Coldwell, Guy Strafer, J. B. Nicholson, J. C. Nichols and H. W. Cheney. Mr. F. G. Bolles is in charge of the exhibit.

American District Steam Company, Lockport, N. Y., employs its booth as an office and reception room. However, there is a complete line of the company's literature at hand, together with detailed data on results obtained by different plants throughout the United States where the American Company's underground system of exhaust steam heating is operated in connection with electric light stations. The members of the company in attendance are Messrs. W. H. Wells, C. R. Bishop, H. C. Kimbrough, W. J. Kline and E. L. Barnes.

American Electrical Heater Company, Detroit, Mich., is represented by the following: Messrs. B. H. Scranton, Frank Kuhn, Robert Kuhn, Guido Kuhn, John Scudder and James Strasburg. Its exhibit consists of the well-known "American" line of electric heating devices, chief among which are the "Steel-Clad" and "Superior" household and laundry irons. In addition to these, the company demonstrates the economy of a number of other devices, such as the toaster, teakettle, chafing-dish, coffee percolater, water heater, disk heater, warming pad, etc.

American "Z" Electric Lamp Company, New York, manufacturer of a non-blackening tungsten lamp having a guaranteed life of 1000 hours and a specific consumption of 1.25 watt per candle, places a number of these lamps on exhibition in a way to bring out one characteristic feature, which is, that the lamp can be burned in any position. Mr. M. D. Kitt is present.

The Anderson Carriage Company, Detroit, Mich., exhibits a Model "D" four-passenger coupé equiped with a 40-cell Edison battery rated at 225 amp-hours. The exhibit is in charge of Sales Manager Mr. G. D. Fairgrieve and Messrs. C. F. and J. R. Brown.

Automobile Maintenance & Manufacturing Company, Chicago, Ill., displays a 1500-lb. Walker balance-gear electric delivery wagon with fancy panel top body. The distinguishing feature of the vehicle is the balance-gear drive in which a single motor housed in a hollow rear axle transmits its power to reduction gearing contained in the hollow rear wheels; thereby enabling the company to enclose all the working parts and protect them from dust and dirt. The mechanism runs in oil and the motor is controlled by a standard starting box placed under the driver's seat. On the street, for demonstration purposes, the company has a 3000-lb. express wagon. Messrs G. R. Walker and G. A. Freeman are in attendance.

Baker Motor-Vehicle Company, Cleveland, Ohio, has on view a four-passenger extension coupé painted in Brewster green and trimmed in green broadcloth, equipped with dome lamp, toilet articles, etc., the windows dropping in the car so as to make it practically an open car in summer; and a victoria. The latter is finished in elephant gray Parisian cloth and is painted in lake with carmine sides to the battery hoods. The body of the coupé is interchangeable with a victoria body so that the model can be employed for winter and summer use. The exhibit, which is quite attractive, is in charge of Mr. O. B. Henderson, who is assisted by Messrs. H. W. Dickerman and K. H. Kellam.

The Benjamin Electric Manufacturing Company, Chicago, is exhibiting representative devices covering its complete line of wireless clusters and lighting specialties. Its principal exhibit is the Parabolite street-lamp reflector. This device is said to represent a distinct advance over older devices used in street lighting. The booth is in charge of Messrs. Harry E. Watson and Geo. C. Knott. The president, Mr. R. B. Benjamin, and the vice-president, Mr. W. D. Steel, are also in attendance.

H. B. Camp Company, New York manufacturer of vitrified clay conduits, displays samples of "Camp-Duct" and some photographs of notable installations of this material. The company is represented by Messrs. R. P. Keasbey and C. C. Baird.

Central-Station Development Company, Cleveland, Ohio, has reserved one of its booths as a lounging place for central-station men, while in the other it shows its system designed to assist electric light managers in building up a new business department that shall contain definite information. The company feels that the hit-and-miss methods of advertising in vogue in not a few places, which deal promiscuously and in a general way with electricity and its advantages, do not produce results commensurate with their cost. In order that a thorough knowledge of conditions in any city may be had the company has devised an elaborate filing system by means of which is placed at the comand of a new business manager the name, address, etc., of every prospective customer in his city or town. Form letters, order blanks, folders, etc., to suit almost every requirement are part of the system. All the cards and systems are shown in its booth in addition to cards and systems for keeping track of prospects, meter reading, follow-up letters, complaints, etc. A 240-page book, entitled "Modern Progressive New Business Methods," in which every phase of business getting

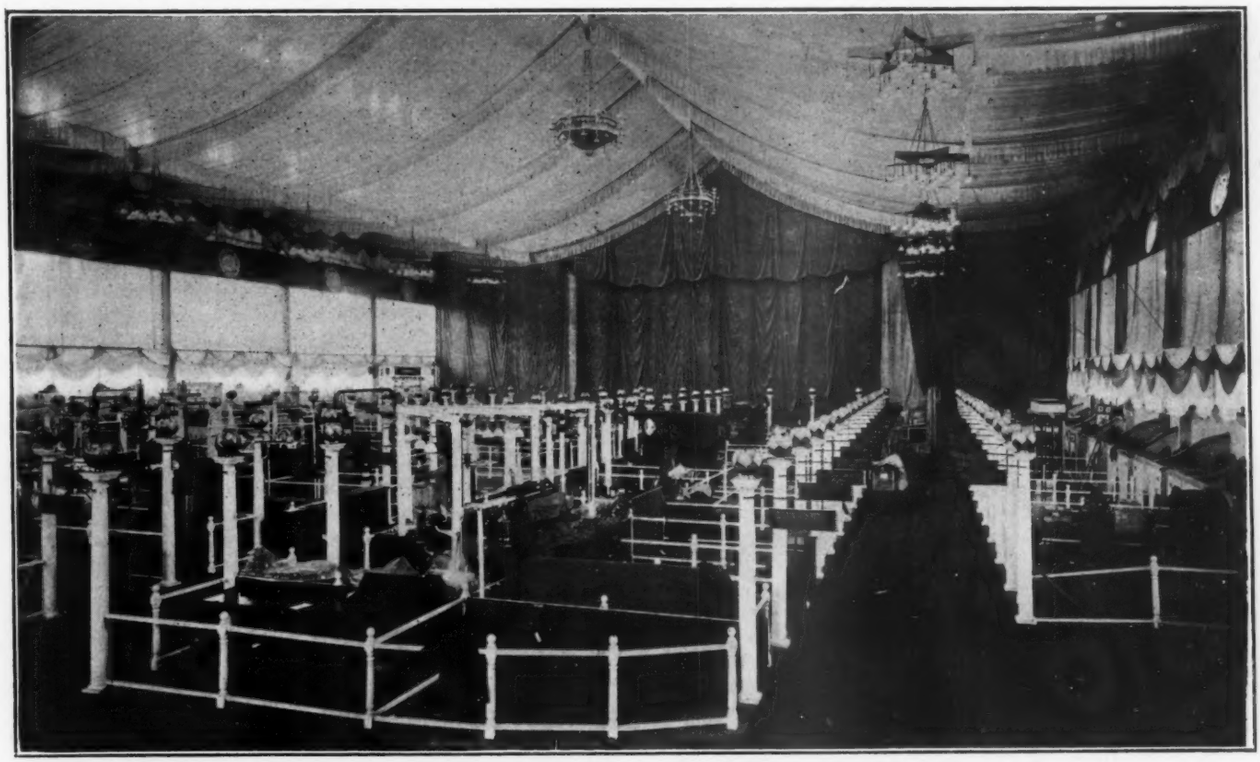
is touched upon and in which the various forms devised by the company are illustrated and described, is given to those interested. Messrs. W. H. Wissing, E. J. Kulas and R. Cole are present.

Century Electric Company, St. Louis, Mo., displays a full line of single-phase, self-starting motors in horizontal types ranging in ratings from ¼ hp to 40 hp, and also shows some vertical motors, back-geared and linotype motors, and its alternating-current ceiling fan. The single-phase motors built by the Century Company are all wound with interchangeable voltage connections, 104-208 being standard. Those representing the company at the convention are Messrs E. S. Pillsbury, R. J. Russell, J. L. Woodress and H. S. Kellogg.

Columbia Meter Company, Indianapolis, Ind., exhibits its house-type, alternating-current type, and astatic switchboard types of meters, together with a rotating test wattmeter. In its direct-current watt-hour meters the company employs silver-capped wire brushes with a mechanical device to hold them in place without increasing the tension, so that any dust which alternators; 5000-kw, direct-current generators, and other installations. The representatives of the company are Messrs. Rodman Gilder, Clarence E. Delafield, Julian Roe, Herbert E. Kerber, H. J. Sage and D. Vance Sickman.

D. & W. Fuse Company, Providence, R. I., displays a number of D. & W. boxes for service switches, main and feeder taps, transformer and junction cut-outs, etc., embraced in the general term subway boxes. An array of fuses and "Deltabeston" wire and coils is also on exhibition. In attendance are Messrs. H. F. MacGuyer, W. S. Sisson, L. W. Downs and Ralph C. Patton.

Dearborn Drug & Chemical Works, Chicago, Ill., manufacture preparations for treatment of boiler-feed waters and hence have no mechanical devices or other appliances to display. The booth is therefore employed for reception purposes. The Dearborn works employ a corps of competent and especially trained analysts, as well as consulting and practical operating engineers, who, through long experience, are said to be able better to cope with the problems of boiler-feed water and the



General View of Exhibition Hall.

may accumulate while the meter is at standstill will roll from under the brushes when the meter is in operation again. A three-part silver commutator reduces the chances of breakdown due to short-circuit or breaking of fine wires leading to the commutator bars. The armature is made up of three form-wound coils and is said to weigh only 90 grams. The shunt loss of this house meter is 2 watts at 100 volts. The features of its various meters are described in printed matter distributed and by Messrs. S. E. Test, C. A. Hornberger and F. L. Pauli, who are in attendance.

Columbus Buggy Company, Columbus, Ohio, builder of high-grade pleasure vehicles and the Columbus electric, because of space limitations, shows only one model and a few working parts. The car shown is a standard four-passenger coupé. Various representatives of the company are in attendance.

Crocker-Wheeler Company, Ampere, N. J., confines its display to sample induction motors and transformers for lighting circuits. The company has on view, however, photographs showing apparatus of its manufacture as large as 5000-kva

intricate troubles experienced in boiler-room practice than others not possessing such experience. The works do not confine themselves to the use of any specific or individual chemical, or mixture of chemicals, or to any individual method of application. After making an analysis of the water and taking into account the conditions existing in the plant at which the water is to be used, resort is had to the use of such chemicals as are deemed most suitable and in such proportions or combinations as are deemed most advantageous and will give the most satisfactory results to the customer. Messrs. George R. Carr, Frank Eardley and H. G. McConnaughy represent the works.

Diamond Rubber Company, Akron, Ohio, has on exhibition representative coils of Code wire—Black Core, "8338" Red Core, 30 per cent Para—small samples being distributed to those who care to make a closer examination. A sample case of Diamond rubber-covered wires and cables, both single and multiple conductor, and lead encased, is displayed. Representing the company are Messrs. O. J. Woodard, O. P. Huben and W. I. Morrow.

Dossert & Company, New York display many new devices in connection with cable splicing. The use to which Dossert lugs have been put for pulling and permanently suspending cables is shown, as well as the application of the lug for taking off a lead to a panel board. One of the features of the exhibit is a board equipped with soldered splices and joints made with Dossert connectors with the relative conductivity of cable and different joints. Various methods of overcoming difficulties by means of the company's connectors are explained by Messrs. H. B. Logan and H. S. Shope.

Duncan Electric Manufacturing Company, Lafayette, Ind., has on view the most comprehensive display of Duncan apparatus ever exhibited. There is a complete line of high-torque, house-type, direct-current and alternating-current, watt-hour meters, together with astatic switchboard type watt-hour meters and a portable rotating standard test meter. Along with this display of meters are shown the company's impregnated-type transformers, which have been on the market now two years and which possess several points of superiority in construction and adaptability to the usual service conditions. The booth is in charge of Mr. Adrian Tobias, who is assisted by Messrs. M. E. Mozingo and John A. Clark.

Edison Storage Battery Company, Orange, N. J., exhibits four types of storage cells intended for commercial and pleasure vehicles, car lighting, launch work and ignition purposes. The cell, which has been described in detail in our columns, is being scrutinized by electric light men who have heard much about its merits for vehicle and train-lighting work. The company does not build large-capacity sells for central-station work to compete with the lead-storage cell and has no intentions for the present, at least, to enter that field; the battery being better adapted for the purposes above enumerated. Those in attendance are Messrs. W. G. Bee, A. J. Doty and C. B. Frayer.

Electric Service Supplies Company, Philadelphia, Pa., devotes its exhibit almost exclusively to Garton-Daniels lightning arresters, although one or two of its specialties are on view, such as Keystone porch lighting fixtures and smaller articles which may be used by central-station companies. In the lightning arrester line the company displays direct-current arresters for voltages up to 1200 and alternating-current arresters for tensions as high as 20,000 volts. Representing the company are Messrs. J. W. Porter, G. W. Fox and J. R. McFarlin.

The Electric Storage Battery Company, Philadelphia, has no general exhibit of large cells, but shows sample plates of its different types. The company is represented by Mr. Charles Blizard, third vice-president; Mr. G. H. Atkin, manager of the Chicago office; Mr. H. M. Marshall, contract agent of the St. Louis office; Mr. H. B. Gay, manager of the Cleveland office, and other members of the force.

Electric Motor & Equipment Company, Newark, N. J., shows a scientifically designed electric portable lamp with inner prismatic glass hemisphere covered with an art-glass shade. There is a regulating switch in the base of the lamp to dim the light. The exhibit is in charge of Mr. S. H. M. Agens.

Excess Indicator Company, New York City, shows a number of its indicators in a booth presided over by Mr. A. T. Holbrook. These devices fill an entirely new field in the extension of central-station service among residences, where, with the adoption of the tungsten lamp, the energy consumption is so low that the expense of installing watt-hour meters, reading them, etc., would be out of the question. The company is offering a new business proposition which should appeal to the lighting companies desiring to acquire residential loads.

Federal Electric Company, Chicago, Ill., shows its regular line of sectional signs, clusters and specialties. In addition to these the company has brought out a new window reflector sign consisting of sectional letters of art glass behind which is a row of adjustable lamps with prismatic glass shades, the light from which illuminates the window as well as the sign. Other apparatus just brought out by the company and placed on exhibition in its booth are a vacuum cleaner and an ozonizer. Messrs. F. H. Welling, Russell Spalding, C. H. Froelich and James M. Gilchrist represent the Federal Electric Company and Mr. H. I. Markham represents the Federal Sign Company.

Fibre Conduit Company, Orangeburg, N. Y., distributes printed matter on its conduit of which samples are on exhibition. The product of this company is made of a bituminous and wood-pulp composition, yet it resists fire, as recent experiences under very heavy short-circuit conditions have conclusively demonstrated. "The Conduit Book" published by the company contains the results of tests made by the New York Testing Laboratories in detail. The conduit is light in weight, easily laid, and possesses high resistance, qualities which make it admirable for underground work. Mr. C. S. Sparrow represents the company.

Fort Wayne Electric Works, Fort Wayne, Ind., has on exhibition a complete line of supplies, meters, transformers, compensarcs, etc. The meters shown include an assortment of house-type watt-hour meters, switchboard-type, round-pattern, glass-covered, watt-hour meters with shunt and series transformers attached and calibrators. The latter are arranged to be used for continuous service and are equipped with diamond jewels. A feature of the exhibit is a testing board for meters. This is equipped with standard wattmeters, shunt and series instrument transformers, reactance load and non-inductive load arranged for testing four meters at once. The meters can be tested and compared with standard inductive loads from a fractional load to overloads with minimum adjustment. The same adjustment can be had on inductive loads of various power factors. All adjustments are arranged in the simplest manner. The transformers on exhibition are of the company's shell type and in order to admit of minute inspection cross-sectional views, made up of standard coils and laminations, are at hand. Bell-ringing transformers, with a core loss of less than 0.4 watt, are shown also in two sizes; one for small bells and the other for large gongs, the latter having a correspondingly higher core loss. Alternating-current and direct-current compensarcs designed to take the place of dead resistance in reducing the voltage for arc lamps such as are used for moving-picture machines also form part of the display and the company is distributing printed matter on the advisability and desirability of using this apparatus in place of wire resistors. A standard alternating-current regulator and panel are set up and used in connection with series alternating-current arc lamps and multiple-arc lamps. The exhibit is withal a running exhibit arranged so that experiments can be carried on any of the apparatus installed for the benefit of visitors. Among the representatives of the company are: Messrs. C. A. Thomas, M. Knight and A. A. Serva.

G. & W. Electric Specialty Company, Chicago, Ill., shows a complete line of its detachable, non-detachable and combination pot-heads. The detachable pot-head consists of a combined pot-head and switch. The construction is such that the device will be operative in manholes filled with water. This is demonstrated at the convention by passing an alternating current at 2000 volts through one of these devices immersed in water. Another form consists of three porcelain members and a heavy copper connector. Two sizes are shown, one for 500,000 and the other for 1,000,000-circ. mil cable. Other features of this instructive exhibit are combination pot-heads and series switches, combination pot-head and subway junction boxes, safety-line disconnectors, and ground-pipe caps. Mr. Albert Wakefield represents the company.

General Compressed Air & Vacuum Machinery Company, St. Louis, Mo., manufacturer of the "Thurman" portable electric vacuum cleaner, exhibits two portable machines driven by ½-hp and ¼-hp motors respectively, and a stationary machine driven by a ¾-hp motor. The cleaners possess a rotary positive-acting pump and a pressed-steel dust receptacle and are readily transported from room to room. Messrs. J. S. Thurman, C. N. Terry and F. Smith are in daily attendance.

The General Electric Company's lamp exhibit includes two 6.6-amp, direct-current, intensified arc lamps; two 12-amp, direct-current, flaming-arc lamps, automatic cut-out and hanger, a complete tungsten lamp exhibit, including tungsten diffusers,

a brass demonstration frame complete with lamps and shades, a cabinet with miniature and low-voltage lamps, a lamp sign, and a bracket with high power lamps of remarkable brilliancy. The fan exhibit contains 8-in., 12-in. and 16-in. fans. All the alternating-current fan motors are of the induction type with the latest improvements. A very complete line of heating devices, which forms a conspicuous part of the exhibit, is of great interest to central-station men, particularly in view of many new devices which are exhibited. The new electric range is attracting attention because of several new features which are involved. It is patterned after the general design of the gas range, having a commodious and especially well heat-insulated oven. The broiler is of the overhead radiant type, being in the oven itself, the upper heating elements of the oven forming the heater for the broiler. The disk stoves on top consume 1500 watts and dissipate twice the watts per square inch usually employed, a feature which is permissible by the use of Calorite wire. A new two-bulb luminous radiator, suitable for operation on the lighting circuit, is shown. A complete line of ornamental or art design chafing dishes and teakettles is displayed. Another device which arrests attention is an electric toaster which turns out nearly 400 slices of toast per hour, or six slices per minute, and is designed for hotel and restaurant use. There are several new industrial devices shown, including the sealing-wax heater and solder-melting pot, besides several new Calorite leaf-unit flatirons for laundry and tailors' use. A line of renewable unit soldering irons is exhibited having open-coil wire handles, which are noted for remarkable coolness. The electric oil tempering bath is a new device which has already proved very popular among steel-tool manufacturers, and is another one of those electric heating applications which marks its rapid progress in the industrial field. The meter exhibit consists of an alternating-current, watt-hour meter with self-contained prepayment mechanism and a direct-current portable voltmeter of the permanent magnet-moving coil type (this latter instrument being one of a complete line of voltmeters, ammeters, millivoltmeters and milliammeters for testing where great accuracy is required) and a 2200/110-volt shunt instrument transformer. There are also on exhibition two automatic feeder regulators. These are of the latest types and are in operation, the installation including contact-making voltmeters, relay switches, exciting transformers and curve-drawing voltmeters, and demonstrate their ability to control automatically the voltage of feeder circuits. The small motor exhibit consists of a 0.5-hp, single-phase, variable-speed motor with controller, a sewing-machine motor, a buffing and grinding equipment, fractional horse-power motors, and portable breast drill.

The company has the following representatives from Schenectady at the convention. Mr. J. R. Lovejoy, vice-president; Mr. C. D. Haskins, manager of lighting department; Mr. J. R. McKee, chairman of sales committee; Mr. D. R. Bullen, manager of supply department; Mr. E. E. Gilbert, manager turbine sales; Dr. C. P. Steinmetz, chief consulting engineer; Messrs. D. B. Rushmore, N. R. Birge, Frank H. Gale, W. D'A. Ryan, C. E. Stone, M. O. Troy and F. G. Vaughn. There are also Mr. W. M. Stearns, manager supply department, Atlanta office; Mr. C. B. Burleigh, Boston office; Mr. J. W. Johnson, manager Chicago office; Mr. F. N. Boyer, assistant manager Chicago office; Mr. W. H. Colman, manager supply department, Chicago office; Mr. J. Scribner, manager of lighting department, Chicago office; Mr. H. C. Houck, manager of supply department, Cincinnati office; Gen. Irving Hale, district manager, Denver office; Mr. G. A. Wooley, manager of supply department, Denver office; Mr. G. N. Robinson, Denver office; Mr. A. D. Page, manager of incandescent lamp sales, Harrison, N. J.; Mr. F. W. Willcox, assistant to manager of incandescent lamp sales, Harrison, N. J.; Mr. A. D. Babson, manager of supply department, New York office; Mr. F. C. Bates, manager of lighting department, New York office; Mr. M. Tattersfield, manager lighting department, Philadelphia office, and Mr. G. D. Rosenthal, manager, St. Louis office.

GENERAL VEHICLE COMPANY, Long Island City, N. Y., features a standard two-ton G. V. chassis and a number of enlarged photographs illustrating the applications of electric vehicles in central-station service for lamp and supply delivery, general contracting, arc-lamp trimming, repair and construction work and also a picture of a recent large order of 1000-lb. and 2000-lb. electrics introduced into Rochester, N. Y., by the Rochester Railway & Light Company, as illustrative of excellent results that repay effort in this direction by central-station men. Representing the company are Messrs. J. H. Vail, P. C. Chrysler and C. L. Morgan.

GUDEMAN & COMPANY, New York, show a sample line of the latest designs of electrical decorations and novelties brought out by them. Included in this line are electrically illuminated rose bushes, lilacs, orchids and other flowers. An illuminated silk-ribbon design is featured. The line built by Gudeman & Company is especially useful for hotel and restaurant decoration and for the home dining-room. Mr. L. Gudeman is looking after his company's interests.

HART MANUFACTURING COMPANY, Hartford, Conn., manufacturer of the well-known line of "Diamond H" switches and which has recently undertaken the manufacture of meter connection blocks, is represented at the convention by Messrs. G. W. Hart, H. A. Hart, A. L. Moses and G. E. Palmer. The exhibit of the company is centered around its new line of meter connection blocks. In addition to its standard switch and receptacle line, there are large capacity meter blocks, service switches and a combination service switch and meter block. There is also a remote-control switch controlled by a thermostat on view. Probably no subject is of more interest to the central-station man at the present time than the proper installation of services and meters, and the comprehensive line of devices covering this field shown by the Hart Company has elicited much interest and comment.

HEINE SAFETY BOILER COMPANY, St. Louis, Mo., has reserved a booth for the entertainment of its friends where central-station men interested in boiler performances can obtain much information of value. A model of a water-tube boiler is shown. The company's works being in St. Louis those interested can visit its shops to see how its product is put together. Mr. J. C. Murphy represents the company.

HUBBARD & COMPANY, Pittsburgh, Pa., feature a line of Peirce all-steel insulator brackets, including some for feeder work. Linemen of the Union Electric Light & Power Company demonstrate the use of the Peirce expansion bolts and hammer drill. Hubbard pole line hardware, which includes everything from pole top pins to ground rods, is also on exhibition, and Hubbard shovels, spoons, digging and tamping bars, etc., are conspicuously arranged about the booth. The exhibit is in charge of Messrs. C. L. Peirce, Jr., and B. S. Handwork.

GEORGE A. HUGHES COMPANY, Chicago, Ill., manufacturer of electric heating devices, has a representative number of its products on exhibition. Messrs. G. A. Hughes, F. B. Thompson and T. M. Caven are in attendance.

HURLEY MACHINE COMPANY, Chicago, Ill., manufacturer of the "Thor" electric laundry machines for the home, exhibits two sizes of these appliances which rob wash day of its terrors. The washing machine and wringer are operated by the same motor, which may receive energy from any convenient incandescent lamp socket. Those in attendance are Messrs. Neil C. Hurley, W. A. Murfey, W. J. Conlon and W. T. Haynie.

W. J. JEANDRON, New York City, who is the agent in this country for the celebrated "Le Carbone" carbon brushes, shows a rather complete line of these for power-house and central-station uses. Longevity, absence of wear on the commutator and excellence in operation are a few of the characteristics of these imported brushes. Mr. Jeandron is giving his personal attention to interested parties and is being assisted in the work by Mr. Halsey Steins.

H. W. JOHNS-MANVILLE COMPANY, New York, features its "Noark" service and subway boxes, "Linolite" electroliers and the J-M fiber conduit and fittings described in these columns last week. The company's Linolite system of lighting is well represented, a striking example being a four-lamp tungsten

electrolier made up of four units with reflectors; the latter being parallel to the tubes of light throw the rays over the space to be illuminated with no under-shadow. These electroliers are fitted with either tungsten or carbon-filament lamps, and the line on display includes weatherproof, window and corrugated-glass reflectors, together with a silver-plated reflector for picture frames and various types of desk and table lamps. Porcelain insulators adapted for all purposes and voltages in both petticoat and disk types with pins, fittings, etc., for transmission work, are also on exhibition. The "Giant" strain insulator is represented by several sizes. Insulating materials for various kinds of apparatus, together with special plugs for heating devices and cooking utensils, are also shown. Samples of "Electrobestos," molded mica weatherproof sockets for lamps, friction tapes and splicing compounds, etc., form part of the elaborate display made by the company. Those in charge are Messrs. H. M. Frantz, George A. Saylor, W. E. Rapp and Robert C. Cole.

W. N. Matthews & Brother, St. Louis, Mo., show working exhibits of their guy anchor, pole erector, cable clamp, holdfast lamp guard, easy lamp changers, easy cord adjuster, cable clips, cable splicing joints, cable roller and linemen's protector shields. The last item the concern contemplates adding to its line of specialties and Mr. H. E. Marshall, of the Linemen Protector Company, is in charge of this portion of the exhibit. A book of specifications on underground conduit is being distributed to delegates. This book contains 96 pages, about 60 of which contain useful information, cost figures and drawings, to enable anyone to lay out a conduit system in accordance with the most approved methods. The balance of the book is given over to descriptive matter of the specialties made by the concern, showing the actual conditions under which they may be used. Messrs. W. N. Matthews, Claude L. Matthews, Victor L. Crawford, Walter E. Bishoff and H. E. Marshall are present.

Metropolitan Engineering Company, Brooklyn, N. Y., aside from samples of new type electric signs and a model showing similar construction to Brooklyn's largest sign, which is equipped with tungsten lamps, gives over its booth to a display of a complete line of the Murray meter protective devices, including seals, porcelain cut-outs with U fuses, porcelain fuse plugs, terminal protectors and many other devices intended to guard central stations against theft of energy. Mr. R. M. Mann is in charge.

Minerallac Electric Company, Chicago, Ill., displays in its booth its printing attachment for watt-hour meters, described in detail in these columns last week. By means of this attachment the quantity of electricity consumed during each hour of the day is printed in ordinary figures on a strip of paper. Three types of instruments are made: one attached to a watt-hour meter and printing at one-hour intervals; another attached to a watt-hour meter and printing at variable intervals, and still another independently mounted and printing at variable intervals. In the booth is also shown minerallac compound which is non-absorptive, possesses high dielectric strength, does not react on copper or any other material used in electrical construction, has a high burning point, is viscous at ordinary temperatures and is self-heating. The company is represented by Messrs. F. F. Kinney and G. F. Oliver.

The Moloney Electric Company, St. Louis, Mo., has on display about 50 transformers covering the following types and sizes: Oil-filled, water-cooled transformers of high voltage; oil-filled, self-cooled transformers contained in corrugated sheet-metal cases; pole-type transformers rated at from 0.6 kw to 50 kw; subway transformers rated at from 1 kw to 60 kw; transformers for use in connection with wireless telegraphy, and transformers for all special purposes, such as variable voltage transformers, series and shunt instrument transformers, auto-transformers, tungsten-lighting, low-voltage transformers, and a few other miscellaneous types. The exhibit is in charge of Messrs. James J. Mullen, John H. Gordon, Henry J. Vogt, H. A. Albrecht and T. O. Moloney.

Monolithic Conduit Company, St. Louis, Mo., shows sections of concrete conduit which has been made in the ditch and dug up for exhibition purposes. In making this conduit system wooden-duct molds of U-shaped section and 16 ft. in length are set in position on aligned supports in the bottom of a trench. Concrete of 1:3:5 mixture is then dumped into place around the molds and struck off even with their tops by means of a straight edge attached to a long handle. When the concrete sets, the forms are removed leaving straight, continuous open grooves which form the duct passages. Concrete slabs are then laid across the open ducts and the whole covered with concrete, making a homogeneous and continuous mass. The exhibition of the company is in charge of Mr. E. C. Freeze.

National Electric Lamp Association, Cleveland, Ohio, has booths at the end of the center aisle facing the main entrance. A large part of this space is devoted to reception purposes; but the exhibit of incandescent lamps is not neglected. On one rack are shown the regular line of Mazda 110-volt lamps, the various sizes of series street lamps, including the 250-watt size, as well as the regular tantalum lamps for 110-volt circuits. In order to admit of a closer examination of the lamps and filaments about 40 of the more common types of Mazda and tantalum lamps are shown in a large cabinet lighted by 40 5-watt frosted sign lamps. Another case is fitted with a line of prismatic glass and steel reflectors and in the center is a large Holophane hemisphere lighted by various colored incandescent lamps. On a brass rack in a glass case are shown burning Mazda miniature and low-voltage lamps, including the various sizes of automobile and train-lighting lamps. A complete automobile electric lighting outfit, including head lamps, side lamps, tail lamps, limousine and meter lamps, is on exhibition. An interesting feature are charts showing the relative and actual costs of producing light. One chart shows that the customer cost is practically the same for all classes of customers; that the capacity cost is the same for equal maximum demands and that the output cost varies with the energy consumed. A second chart shows what percentage each of the cost items is of the total expense of serving different customers. It shows that in the case of a small consumer, the customer expense is large compared with the total cost; but that with the large consumer the capacity and output costs make up the greatest part of the total expense. The following members of the engineering department are in attendance: Messrs. S. E. Doane, G. C. Webster, W. M. Skiff, P. F. Bauder, G. S. Merrill, H. S. Hall, J. D. Hoit, M. D. Cooper, C. O. Brandel, A. J. Hitzker and R. E. Scott

Otis Elevator Company, New York, shows an elevator machine adapted for single-phase current operated by a push-button controller. Owing to space limitations it was impossible for the company to show its full installation of a push-button machine, so that merely the elevator machinery is exhibited; a bank of push-buttons for operating the machine being shown on a separate panel. The representative of the Otis Company is Mr. H. S. Wells.

Philadelphia Electrical & Manufacturing Company, Philadelphia, Pa., has a line of lighting appliances on view consisting of fuse boxes, absolute cut-outs, metallic conduit joint wrappers, locust pins, incandescent street-lighting fixtures, etc. An attractive display of so-called tungsten arc lamps, of which this company is the originator, is made. These lamps are being used for all classes of lighting throughout the country and are immensely popular. They are shown in a number of different finishes, one rated at 400 cp being quite conspicuous. Messrs. C. L. Bundy and W. O. Dale are at the booth.

Pittsburgh Transformer Company, Pittsburgh, Pa., has a line of standard transformers ranging from 0.6 kva to 50 kva in rating in its booth. The company shows high-voltage step-up and step-down transformers for heavy duty, and its well-known mill-type designs, of which some 75,000 kw have been installed in steel mills and factories in the United States, meeting the hard usage to which machinery in such places is subjected, are conspicuous. Small high-voltage switchboard transformers, for use in connection with switchboard instruments, are also displayed. Messrs. H. G. Steele, R. V. Bingay, P. H. Butler, L. H. Briggs, C. R. Lininger, L. C. Mitchell, F. T.

Wyman and G. H. Horne are in attendance and distribute the pretty girl booklets and Pittsburgh stogies, a custom dating back many years.

RAUCH & LANG CARRIAGE COMPANY, Cleveland, Ohio, has as its representatives at the convention Messrs. H. J. Killius and C. E. Michel. The latter is connected with the Union Electric Light & Power Company, of St. Louis, and has charge of the exhibit during the convention. The company is exhibiting a large 40-cell coupé

RICKER MANUFACTURING COMPANY, Rochester, N. Y., has a display of interest to distribution departments of electric light companies. Included in the exhibit is a Rochester oil-fuse box installation showing a standard size pole line and manhole for subway construction, protecting the branches on a three-phase, 4150-volt system. A cable junction box, connected in a manhole, shows the application of this device to two-wire or three-wire, 250-volt mains and feeders. In order to protect companies against theft of energy, the company has devised a meritorious meter and service box, which is shown connected. A feature of this box is that meters may be changed or tested without interrupting the consumer's service. A non-freezable oil, known as "Rochester" fuse oil and which is claimed to remain in normal condition at temperatures 40 deg. below zero, is also shown. Mr. George Hearn is in charge of the booth.

THE SANGAMO ELECTRIC COMPANY, Springfield, Ill., is showing its mercury-motor, watt-hour meter for both direct-current and alternating-current service in both residence and switchboard types; amp-hour meters for storage-battery work. The meters are exhibited on pedestals of novel design, arranged so that a cluster of lamps on the top of each pedestal will be cut on and off by moving the meter in a small arc about the pedestals. A feature is also made of a very large working model illustrating the Faraday disk principle, the disk of the model being 12 in. in diameter, and immersed in a mass of mercury amounting to over 35 lb. This is arranged for actual operation and shows in simple form the fundamental principle of all mercury-motor meters. The company's representatives at the convention are Mr. Jacob Bunn, president; Mr. R. C. Lanphier, secretary and manager; Mr. I. A. Bennett, sales manager, and Messrs. J. H. Hodde, A. D. Birnbaum, Scott Lynn and Frank Pride.

SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., occupies two booths where electric heating apparatus of all sorts is displayed and demonstrated. Included in the articles for household use are flatirons, heating pads, instantaneous water heaters and nursery milk warmers. For the dining-room there are toasters, coffee percolators, chafing dishes and teakettles. For light cooking there is displayed a line of portable stoves with separable and interchangeable utensils. For regular household cooking a Simplex range is shown. This has an oven, on top of which are mounted a broiler and a number of disk stoves with separable and interchangeable utensils, all controlled by a bank of switches allowing the use of 3 deg. of heat on each article. The commercial display includes many types of laundry and tailor's irons in various weights and shapes and also includes the automatic stand and suspension arm, two features of Simplex installationes. The purpose of the stand is to cut out part of the energy when the iron is placed on it, preventing overheating, but keeping the iron hot enough for instant use. The suspension arm serves to hold the cord off the table and out of the operator's way, preventing kinking and breaking of the cord. For factory use various types of glue pots and soldering coppers are on exhibition. A feature of the exhibit is the method of using stoves and utensils. The utensils are separable from the stoves, allowing them to be readily removed and washed without danger of damage to the heating element, but are also provided with a locking device which holds the bottom of the utensils in intimate contact with the top of the stove, insuring a maximum transmission of the heat and making them in effect self-contained heaters. A slight twist of the utensil locks it firmly to the stove. The Simplex method of construction consists of a cast-iron plate, to the under side of which are fused several layers of enamel in which the wire resistor is enclosed. In this way the wire is sealed from atmospheric exposure and the enamel being practically an integral part of the heater plate insures rapid and efficient transmission of heat. The company is represented by Messrs. J. I. Ayer, H. L. Hixon, E. R. Jacobs and H. F. Holland.

STANDARD UNDERGROUND CABLE COMPANY, Pittsburgh, Pa., has a complete exhibit of cables for all uses and various cable accessories. Samples show insulations of paper, varnished cloth and rubber, covered with both lead and armor, separately and collectively. Coils of "Colonial" copper-clad wire, in various forms, wearproof mining machine cable with square and ribbon magnet wire, and rubber-covered and braided material are also on view. The line of cable acessories include Davis station and open-air terminals for cables of all sizes and for tensions as high as 25,000 volts, multi-unit junction boxes, cable hangers and Ozite jointing compound. Representatives of the company in St. Louis during the convention are Messrs. E. J. Pietzcker, R. C. Houck, J. R. Wiley, B. S. Stewart, C. J. Marsh, A. A. Anderson and J. H. Lytle.

STAR ELECTRICAL CONCERN, New York City, has one of each of the five different styles of flaming-arc lamps which it makes hanging in its booth. These lamps operate on a combination of the flaming and the intensified arc principles. They may be connected in multiple on 100-volt to 120-volt direct or alternating-current circuits, taking 3.3 amp on the former and 4.4 amp on the latter. The power factor of the lamp is said to be approximately 95 per cent. Two indoor lamps are equipped with prismatic glass reflectors. This type of lamp is furnished with a standard Edison base so that it can be screwed into the ordinary lighting socket. Similar lamps for indoor use are equipped with a suspension ring and terminal binding posts. Of the outdoor-type lamps, one has a combination steel-enameled case and reflector for broad distribution; another has a reflector to give downward distribution, and in still another the steel-enameled case is developed into a parobolic reflector to give downward and sidewise illumination for lighting billboards, etc. By means of instruments the energy consumption of each lamp is shown. Mr. W. H. Gardiner is in charge of the company's interests.

STUDEBAKER AUTOMOBILE COMPANY, South Bend, Ind., is represented at the convention by Messrs. J. M. Hill, W. Hunnewell, A. Kelly, W. P. Kennedy, E. W. Curtis, C. F. Redden, W. J. Donlan, Hayden Eames, D. F. M. Weeks, A. R. Davis, Louis Kuhns. Chas. Quigley, C. Weaver and E. Michael. The exhibit made by the company comprises a victoria phaeton, a folding front landaulet and a 1500-lb. delivery wagon. The company shipped from South Bend a fleet of Studebaker gasoline cars for use of convention delegates and also sent chauffeurs from the same point.

TUNGSTOLIER COMPANY, Cleveland, Ohio, exhibits one of its five-lamp folding tungstoliers suspended from an arch and connected up to a small motor concealed in the arch; the motor being geared to a mechanism which will slowly raise and lower the arms of the fixture, which is fully equipped and lighted. There is besides a complete equipment of the company's campaign literature showing results of its campaign methods in many central stations. A souvenir booklet, containing illustrations of some of the more important installations made by the company, is distributed, together with other literature and catalogs. In attendance are Messrs. F. C. Maxheimer, W. H. Fisher and Howard Kulas.

UNITED STATES LIGHT & HEATING COMPANY, New York, shows a complete line of all types of its batteries, including stationary cells of the "V" type installed in glass jars, "W" type installed in lead-lined tanks and accessories thereto. There is also a line of sparking batteries, vehicle plates, grids and completed cells; the new "National" auto-lighter battery for automobile engine ignition and lighting, and a complete equipment of car-lighting plates and cells. The company's exhibit covers the entire storage-battery field and is in charge of Messrs. A. H. Ackermann, J. Allen Smith, C. C. Bradford, W. F. Bauer and B. Smith.

WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., makes a very complete display of its products. Inside the

frame of a 400-hp polyphase motor is shown one of the smallest frames to demonstrate the extremes of its motor manufacture. The core and coils of a 10-kw and a 15-kw transformer are exhibited; the former transformer being of the core type and the larger of the shell type. Included in the exhibit are a standard 10-hp, three-phase motor and a 30-hp, three-phase vertical motor. The latter is marked by an ingenious and effective oiling of the vertical bearings, which has always been conceded to be quite a mechanical problem. In order that the centrifugal governing device of the single-phase motor might be seen to advantage a skeleton of a single-phase motor is shown with the device exposed. The rotor of this skeleton is revolved by a 0.5-hp motor, so as to illustrate the operation of the device which transforms a single-phase motor from a repulsion motor at starting to an induction motor after attaining speed. The Wagner delegation is as follows: Messrs. W. A. Layman, Walter Robbins, W. S. Thomas, F. N. Jewett, V. W. Bergenthal, A. H. Timmerman, C. B. Lord, John Mustard, E. H. Cheney, E. W. Goldschmidt, Dean Emerson, O. H. Davidson, F. Johnson, T. T. Richards, E. D. Pike, J. F. Jones, J. W. Westcott, W. W. Briscoe, M. Hearn, C. M. Duncan, Ray Flagg, E. Ballman, O. Weimer, H. Weichsel, E. L. Coolidge, S. Sparrow and Ray D. Lillibridge.

Warner Arc Lamp Company, Wilton Junction, Ia., manufacturer of flaming, enclosed and tungsten arc lamps, has a number of these on exhibition in its booth. The merits of the tungsten low-voltage arc lamps, which are called arc lamps only because they resemble in outward appearance the arc lamp made by the company and give an illumination about equal to an enclosed arc for the same expenditure of energy, are set forth at length by an advertising cabinet in the center of the booth. Messrs. W. F. Warner and C. K. Ross look after the company's interests.

Waverley Company, Indianapolis, Ind., exhibits a four-passenger brougham and a mounted Waverley high-efficiency shaft drive showing the complete driving mechanism of the car in operation. The herringbone gears used in this drive are of the same general pattern as those employed in the building of marine turbines, which recent experiments have shown to possess an average efficiency of 98.7 per cent. The drive of these vehicles has been described in our columns a number of times. Messrs. W. C. Johnson and L. C. Voyles represent the company.

The Wesco Supply Company, St. Louis, has not undertaken to make an elaborate exhibit, but shows new and interesting devices, among which is the Steiner family motor designed for the operation of household conveniences, such as washing machines, clothes wringers, ice-cream freezers, house pumps, meat cutters, sewing machines and vacuum-cleaner attachments. In connection with Wesco combination alternating-current and direct-current desk fans is shown the Helvetia oscillator for both the desk type and the bracket type. In order to illustrate some new types of Triumph motors there is installed in the exhibit both 220-volt and three-phase induction motors. There is also shown for the first time a new line of both direct-current and alternating-current motor-starters of the Allen-Bradley make. There are Wagner indicating instruments and Sangamo service and switchboard-type recording meters. In addition there is shown the new regenerative flame-arc lamp manufactured by the Adams-Bagnall Electric Company.

Western Electric Company has a comprehensive display of telephones, electrical apparatus and central-station supplies. The telephone exhibit consists of various types of "Bell" instruments and also various types of telephones for interior service. The electrical apparatus on view includes alternating-current and direct-current motors of various sizes, transformers, sewing-machine motors, fans and ventilating equipments. In the arc-lamp display are Hawthorn flaming arcs, Solaris arcs and Hawthorn enclosed arcs. The flaming-arc lamps are made in two standard sizes, burning 14 and 18 hours respectively and giving at 550 watts about 3000 cp. The exhibit is in charge of the advertising department and those in attendance are Messrs. E. W. Rockafellow, F. D. Killion, F. X. Cleary, W. L. Stockton, H. L. Grant, L. T. Milnor, C. H. Talmage, G. E. Cullinan, E. Devine, W. J. Doherty, L. F. Philo, Burt Crouch and P. A. Morse.

Westinghouse Companies exhibit includes displays by the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company and the Westinghouse Lamp Company. The apparatus displayed by the Westinghouse Electric & Manufacturing Company included a representative line of its smaller apparatus, particularly the small motors. Larger direct-current motors are represented by type "S" motors for general industrial service; alternating-current motors by the type "A" single-phase, the type "HF" phase-wound secondary, and type "MS" squirrel-cage secondary motors. This latter motor has just recently been placed upon the market and is designed for severe industrial service where a heavy and practically indestructible motor is required. The small motors are shown in sizes from 1/12 hp to ¼-hp for both direct-current and alternating-current circuits, together with a complete line of buffing and polishing motors. Controlling apparatus for both direct-current and alternating-current motors is shown, including a new auto-starter for squirrel-cage motors. This starter is so designed that the motor can be started only by throwing the handle to the starting position first and then to the running position, and it is impossible to leave the handle on the starting position, thus adapting the starter for service by operators ignorant of the ways of electricity. There are also displayed a complete line of alternating and direct-current arc lamps, including both multiple and series types, and a line of heating apparatus comprising several sizes of luminous radiators, air heaters, toaster stoves, disk stoves, domestic sadirons, tailors' irons and other apparatus. Several types of lightning arresters for both high and low-voltage are exhibited. A feature is a new automatic type of mercury rectifier used for charging automobile storage batteries and shown in operation. This rectifier is connected so that the load can be gradually increased from about 20 amp to 5 amp to show the automatic feature by which the rectifier cuts out when the batteries are fully charged. Another feature is the new type of automatic voltage regulators which are connected into the service which supplied energy to the sections of the building and maintains the voltage uniform regardless of the current variations.

The Westinghouse Lamp Company features its newest type of tungsten lamps, which have just been placed on the market; namely, the wire-type or continuous filament lamp. The manufacture of these filaments has been so improved that instead of four or six hairpins of tungsten, there is but one long wire of tungsten. The 500-watt, 250-watt, 150-watt, 100-watt and 60-watt types are shown burning as commercial products, while the 40-watt and 25-watt types are shown in a lay exhibit, merely as an engineering product and not for commercial manufacture. This is but a temporary condition, for these smaller sizes will soon be on the market as well as the larger sizes. The new wire-type lamp shows a marked increase in strength over other types of construction. The company has a very complete display of its product and shows practically all sizes of the 110-volt and 220-volt tungsten lamps, as well as several types of low-voltage and sign-lighting tungsten lamps. The latter type of lamps are operated from economy coils and sign-lighting transformers. There are also several types of metallized-filament street series-tungsten and automatic tungsten lamps, as well as special sizes of carbon-filament lamps on view. Among those in attendance at the exhibit are the following: Messrs. L. A. Osborne, S. L. Nicholson, C. S. Cook, Chas. Robbins, G. B. Griffin and J. C. McQuiston, as well as most all of the district office managers of the Westinghouse Electric & Manufacturing Company. The Westinghouse Machine Company is represented by Messrs. E. H. Sniffin, C. C. Chappelle and A. A. Rogers. The Westinghouse Lamp Company is represented by Messrs. Walter Cary, T. G. Whaling and B. F. Fisher, Jr. Mr. W. Barnes, Jr., of the Westinghouse Bureau of Publicity, is in charge of the exhibit.

Yawman & Erbe Manufacturing Company, Rochester, N. Y., shows an electric copying machine and filing cabinet. Mr. Cole is in charge.

Industrial and Commercial News

THE WEEK IN TRADE

ALTHOUGH weather conditions have been much more favorable and there is a more cheerful tinge to the crop reports in consequence, the improvement in retail trade last week was not particularly noticeable. This improvement will probably come later when the crops are further advanced. Wholesalers and jobbers report very dull business, orders being mainly for filling-in purposes, and these not at all extensive. As a matter of fact, there is some evidence in many sections of the country that the early views of spring trade were too sanguine, and many dealers accumulated stocks which they have not disposed of as rapidly as they had anticipated. This condition, of course, has its effect upon collections, and is generally detrimental to an active movement. In some industrial lines, especially among the textiles, orders are so few that further curtailment is under discussion. In no industrial center is there any distinct improvement, although the sentiment in the iron and steel market is considerably better than it was a fortnight ago. The curtailment in the production of pig iron has relieved the strain in that market, and the mills making finished material continue to be busy, though for the most part they are now working on orders taken some months ago. During the past week there were some large orders for cars placed, and structural material was contracted for to the extent of about 50,000 tons. There was also a better demand for tubes and pipe. Steel rails are very quiet, and wire products are not in as heavy demand as earlier in the season. The condition of foreign trade is still unsatisfactory. In volume it has receded very considerably, and while imports are much less than they were earlier in the season, exports of food products, even at the lower prices now prevailing, are not what had been anticipated. Exports of manufactured products show some gains. The general tone of business is one of conservatism and of postponement. No one seems anxious to make heavy commitments under present conditions. Business failures for the week which ended May 19, as reported by *Bradstreet*, were 225 against 216 the week previous, 219 in 1909, 284 in 1908, 165 in 1907 and 170 in 1906.

THE COPPER MARKET

DOMESTIC consumers were not at all eager to buy copper last week and the transactions recorded in that market were very few. The speculative demand from abroad was interrupted for three days on account of the holidays in the foreign markets so that the volume of trading could not be large. There were enough buying orders, however, to support the market fairly well and prices for futures were stronger at the close of the week than at the beginning. It is said that in the home market some of the independent producing and selling companies have been making concessions to small buyers and that, as a result, quite a number of minor sales had been made for May and June delivery. Statistically there are no new developments in the market. Production continues at the record-breaking rate that was established in April and the consumption of metal is no larger than at any time since the beginning of the year. Imports have continued to be quite liberal, but are probably a trifle less than they were in April. The indications are, however, that there will be considerable addition to domestic stocks when the association's figures are given out. Speaking of the position of the market, the monthly circular of the National Conduit & Cable Company has this to say: "In view of the April increase in copper stocks the market improvement could not be traced to a statistical betterment on the situation. Good consumption in this country has prevented a more rapid increase in the domestic stocks, but if production continues unabated, the low level of prices has not been safely passed. Copper production will increase for many years if developments prove equal to those of recent years. Low-grade mines can produce so cheaply that plans are being considered for increased output and the supply of new production is rising to unprecedented size. Reports show how the production of copper is being forced notwithstanding the enormous stocks carried in this country and in Europe. An output more nearly adjusted to requirements would prove a benefit to both consumers and producers." The exports for the month have been only fair, being 14,464 tons up to and including May 23. The daily call on the Metal Exchange, May 23, quoted standard copper as per accompanying table.

Standard Copper.	Bid.	Asked.	Settling price.
Spot	12.50	....	....
May	12.50	....	12.52½
June	12.50	12.55	12.52½
July	12.50	12.55	12.52½
August	12.50	12.60	12.55

The London market May 23 was as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	56	8	9	56	6	3
Standard copper, futures	57	7	6	57	5	0

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	13.50c			12.05c		
London, spot	£62	0	0	£55	2	6
London, futures	65	18	9	56	2	6
Best selected	65	10	0	59	10	0

INDUSTRIAL AND COMMERCIAL NOTES

Chicago Lighting Contract.—The city of Chicago now buys energy from the Sanitary District for 12,200 arc lights and rents 750 arc lights from the Commonwealth Edison Company. It is now proposed to discard the latter and increase the former service by 10,000 arc lights, making a total of 22,200. The cost last year of these lights was $580,000, being an average of $43 per Sanitary District light, including maintenance, and a rental of $75 for the Edison lights. Under the new arrangement the Sanitary District charge will be $29 per light, which does not include interest on the proposed bond issue, which would be equivalent to about $3 per light, making the total cost to the city for the 22,200 lights of $710,400. The city owns four modern and three obsolete substations. The Sanitary District guarantees adequate facilities for lighting and expects to have extra energy which can be sold for power purposes. The city officials of Chicago say that under the new arrangement that the city will be the best lighted in the world.

Patapsco Electric Light & Power Company.—The Patapsco Electric Light & Power Company, of which Victor G. Bloede is the president, is about to be granted a franchise to operate in the western section of Baltimore. Mr. Bloede last week presented to the Board of Estimate his proposition, and when the rates are approved the franchise will be given. The rates proposed for domestic consumption are, maximum, 8 cents per kw-hour; if bill exceeds $5 per month, 7½ cents, and if the bill exceeds $10, 7 cents. For manufacturing, the rates range from maximum of 5 cents down to 2 cents. If the total gross receipts of the company in any one year should reach $100,000, it is provided that the company shall reduce the maximum charge for domestic current from 8 to 7 cents. In addition to the agreement as to rates, the representatives of the company agreed to pay the city 1½ per cent of the gross revenue as a franchise tax and also to pay taxes on the easements.

Business Publicity.—At the fifteenth annual meeting of the National Association of Manufacturers, held in New York last week, the committee on business publicity urged that members of the association should insist on publishers making known to advertisers their exact paid circulation. It recommended membership in the Association of American Advertisers, which body makes systematic investigation of the circulation of periodicals for the benefit of its members. It also asked that the Postmaster-General shall print 100,000 copies annually of the findings of the inspectors of publications, which give the result of investigations of circulation by post-office officials.

General Electric in San Francisco.—The General Electric Company has recently leased a six-story building on Second Street, in San Francisco, which it will use for its Pacific Coast headquarters. The building has a frontage of 60 ft. on Second Street and 74 ft. on Minna Street, and is a handsomely finished office structure. It is the purpose of the General Electric Company to occupy the entire building.

European Business Improving.—Hugo Reisinger, who has just returned from an extended business trip to the Continent, reports that he found business very much improved in the electrical industries. This, he said, was especially true in Germany, where the works all seemed to be well employed. The condition of the trade was certainly much better than it was a year ago. Referring to the factory of C. Conradty, at Nuremberg, for which Mr. Reisinger is the American representative, he said: "Our factories are so rushed with orders for lighting carbons that they are working night and day. I could now place heavy orders for the coming season, notwithstanding the increase in the duty under the new tariff law. This shows again the folly of the tariff and proves that it is not the importer who bears the burden, but the consumer. One thing that I noticed particularly abroad is that Germany, as well as England and France, has lately taken up, with considerable interest, the question of street lighting with flaming arcs. In Europe, you know, the cities want the best street lighting possible and do not consider the cost; in this country the cities are satisfied with any sort of lighting, so long as it is not too expensive."

Edison Electric Illuminating Company of Boston.—The April earnings of the Edison Electric Illuminating Company of Boston showed an increase of 15.6 per cent in gross returns and 16.9 per cent in net. These unusually large earnings, which compare with an 8 per cent increase in net for the ten months ended April 30, were due to the fact that the company only recently commenced to secure any returns from its $3,000,000 investment in the purchase of new business in Newton, Chelsea, Watertown, Brookline, Brighton and Waltham. This business was acquired by the purchase of the electric plants in these places from the Massachusetts Gas and Boston Suburban interests. Another addition to the business of the company comes from the contract made last fall to supply the Boston Suburban Electric Companies with energy to operate its street railway lines. Another large contract recently made is with the Hood Rubber Company to supply its 2000-hp plant at Watertown with energy, replacing steam power.

Mexican Northern Power Company.—According to the first annual report of the Mexican Northern Power Company the original estimate of $8,000,000 as the total cost of the company's works seems to have been excessive. It now appears that the cost will be hardly more than $7,000,000. The report states that the main line of the Mexican Central Railway is now connected with the works of the power company by a branch line, so that it will be an easy matter to equip the plant with proper machinery. Recently the management secured franchises giving the company full right to furnish light and power to several additional cities and towns, and at the present time 750 men are working on the big dam, which is expected to be completed during the coming summer.

Crane Falls Power & Irrigation Company.—Plans have been completed by the Crane Falls Power & Irrigation Company with a hydroelectric plant at Crane Falls on the Snake River, in Idaho, for the construction of a feed canal and head works that will increase the output of the plant to about 14,000 hp. The energy will be utilized for lighting and heating purposes in the southern part of the State and for pumping water for irrigation systems. Arrangements have already been made for the irrigation of about 10,000 acres near Grand View, Idaho. It is planned to extend the transmission lines into the mining sections of northern Nevada. Smith, Kerry & Chace, of Toronto, are the engineers, and Canadian capital is back of the project.

New Jersey Subway Project.—The Hudson County, (N. J.) Board of Freeholders at its meeting last week took action looking toward the construction of a subway under the Boulevard, to run the entire length of the county from Bayonne, through Jersey City, West Hoboken, Union Hill and North Hudson, to the Bergen County line. The subway as proposed will connect with the McAdoo tunnels and other lines leading into New York. A committee was appointed by the Board of Freeholders to ascertain a feasible method of financing the project, and a committee of engineers named to look into the matter.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions of present plants at Brainerd, Minn.; Wheeling, W. Va.; Bedford City, Va.; Crawfordsville, Ind.; Cullman, Ala.; Dalton, Ga.; Merritt, B. C., Can.; Wheeling, W. Va.; Mountain Home, Idaho; Grafton, W. Va.; Philadelphia, Pa.; Readfield, Me.; Provo, Utah; Fort Snelling, Minn.; Athens, Ohio; Brooklyn, N. Y.; Idaho Falls, Idaho; Seattle, Wash.; Trenton, N. J.; Farmingdale, Me., and Fayette, Mo.

Inspecting Pennsylvania Tubes.—The first fully equipped passenger train with an electric locomotive to pass through the new Pennsylvania tube from Harrison, N. J., to Long Island City was run last week. The train carried 135 officials connected with the passenger departments of the Pennsylvania system from all parts of the country. The work of finishing the tubes and terminal station is being pushed rapidly.

New Hoboken Terminal.—The Public Service Corporation of New Jersey has opened its new trolley terminal station at the foot of Ferry street, Hoboken. The new station is immediately above the Lackawanna terminal of the Hudson & Manhattan Railroad tunnel. The trolley station consists of two floors and will handle 180 cars an hour of 60 passengers each. The station cost about $250,000.

South American Cable Rates Reduced.—The Central & South American Telegraph Company has announced a reduction in its cable rates to Peru, Bolivia, Chile, Argentina, Uruguay and Paraguay. The new rate will be 15 cents per word, to apply to messages originating in the United States and Canada. This rate goes into effect June 1.

Large Tantalum Lamp Order.—The Bryan-Marsh Company, of Chicago, has just secured an order from the Chicago Railways Company for 55,200 series-burning street-railway tantalum lamps of 16 cp and 32 cp. This is said to be the largest single order ever placed in this country for tantalum lamps.

Western Electric Telephone Selector.—Although scarcely yet on the market, the Western Electric Company has received orders from three of the largest railroad systems for its new telephone selector outfit for use in connection with train despatching.

Financial.

THE WEEK IN WALL STREET.

THERE was little feeling that it was a hardship upon the traders in Wall Street for business to be checked for two hours last week in order to pay respect to the memory of England's departed King. There was so little business being done at any time during the past week that the delay caused no inconvenience. If the holiday had been half a week no one would have lost money thereby. The week taken as a whole was one of the most uninteresting from a business point of view of any that the street has experienced for several years. So far as commission business was concerned it was a negligible quantity, and the volume of profes-

NEW YORK.

	May 16.	May 23.	Shares sold.		May 16.	May 23.	Shares sold.
All.-Ch.	9⅝	9⅝*	600	Int.-Met., pfd.	55⅛	55⅞	10,605
All.-Ch., pfd..	34*	34*	———	Mackay Cos..	89	89*	100
Amal. Cop...	71½	70⅜	80,150	Mackay C., p.	76	76*	100
Am. D. T...	20½*	20½*	———	Man. Elev...	136*	134	100
Am. Loc.....	49¾	49	3,000	Met. St. Ry..	15*	15*	———
Am. Loc., pfd.	110*	110	340	N.Y.&N.J.Tel.	139¼*	139¼*	———
Am. Tel. & C.	75*	75*	———	Steel, com...	83⅜	83⅝	275,325
Am. T. & T..	137	136⅝	5,220	Steel, pfd....	118¼	118¼	8,500
B. R. T.....	80½	81½	49,235	W. U. T....	68⅛	68	750
Gen. Elec....	149¾	150½	1,450	West'h., com.	64½	65	1,450
Int.-Met., c'm.	20½	20½	4,800	West'h., pfd..	110*	110*	———

PHILADELPHIA.

	May 16.	May 23.		May 16.	May 23.
Am. Rys.....	45	45	Phila. Elec.....	15¼	15⅜
Elec. Co. of A.....	12	12*	Phila. R. T.....	20¼	18⅜
Elec. St. B'ty.....	59¼	59½	Phila. Trac.....	86½	86
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	49	48

CHICAGO.

	May 16.	May 23.		May 16.	May 23.
Chi. City Ry.....	180*	180*	Chi. Tel. Co.....	114⅞	115½
Chi. Rs., Ser. 1....	90*	90*	Met. El., com.....	19*	19*
Chi. Rs., Ser. 2....	28¾*	17	Met. El., pfd.....	58	56½
Com. Edison.....	113*	113½	Nat'l Carbon.....	108¾*	109*
Chi. Subways.....	2½*	2¾	Nat'l Car., pfd.....	115	115

BOSTON.

	May 16.	May 23.		May 16.	May 23.
Am. T. & T.....	137	136¾	Mex. Tel.....	6¼	6¼
Cum. Tel.....	146	146*	Mex. Tel., pfd.....	7	6½*
Edison E., Ill.....	250¼	250	N. E. Tel.....	134	133
Gen. Elec.....	148¼	151	W. T. & T.....	16	16*
Mass. E. Ry.....	18	17½	W. T. & T., pfd....	86*	88
Mass. E. Ry., pfd...	86	86			

* Last price quoted.
Shares sold for week of May 16 to May 21.

sional operations was insignificant. In the midst of all this apathy and almost somnolence, prices not only remained firm, but in most cases advanced a point or so. There was no selling movement visible and no semblance of any bear campaign. The tone of the market was good—wherever a tone could be discerned—but there was no enthusiasm about the performance and little interest. As far as the actual news of the financial world was concerned there was little that was of sufficient importance to have any effect in either direction. The contest over the provisions of the railroad bill in Congress probably formed a more general topic of conversation than any other thing, but even this matter was regarded with great indifference. It is the general opinion that the railroads will not be put out of business and that the courts will not force them to conduct their business at a loss. The iron and steel trade is believed to be in an improved condition and the undoubted tendency in all the commodity markets toward lower prices had a distinctly encouraging effect. It is pretty generally agreed that until cotton, grain, meat and dairy products reach materially lower levels it will be useless to anticipate a foreign trade that will put a balance on the right side. The money market was easier and cash was plentiful. Loans were made during the week as low as 2 per cent and at all times there was an abundance of funds for all who wanted accommodation. Although there was less said than during the week previous about placing American securities abroad, it was generally understood that these negotiations were progressing. The domestic bond market was stagnant and no placements of any importance were reported. Quotations for money on May 23 were call: 3@3½ per cent; 90 days, 3¾@4 per cent. The quotations in the table are those of the close, May 23.

FINANCIAL NOTES.

Metropolitan Reorganization Plans.—G. E. Tripp, chairman of the joint committee of the Metropolitan Street Railway bondholders, has issued a statement to the effect that all publications that have heretofore been made purporting to outline the plan of reorganization adopted by the committee are erroneous, and that no authorized statement of this plan has been given out. He said that such a statement will probably be made in the near future. There are many details to be arranged, but the joint committee has mapped out a plan which in general terms meets with the approval of the committees representing the 4 per cent refunding bonds and the 5 per cent mortgage and collateral trust bonds. The plan will have the profit-sharing feature, by which the city will be given a percentage of the earnings in lieu of tax payments. If an agreement as to the plan is not reached before the property is sold at foreclosure, which will probably be in June, the bondholders will bid in the property and work out the details of reorganization later. A draft of the proposed decree of foreclosure and sale was presented to Judge Lacombe last week, but was not approved. He said that the plan would allow those interested in the reorganization to get the property without even paying the $10,000,000 upset price fixed by the court decree in the first mortgage judgment.

Pennsylvania Water & Power Company.—J. E. Aldred was last week finally discharged as receiver of the McCall Ferry Power Company, by order of the United States Court, and his bond has been cancelled. After showing that the coupons on the $9,027,000 bonds for Dec. 15, 1908, June 15 and Dec. 15, 1909, had been paid the bonds themselves were turned over to W. H. Barnum, who bid in the property for the bondholders. The property has been formally turned over to the Pennsylvania Water & Power Company.

Fall River Electric Light Company.—The Massachusetts Gas Commission has approved an issue of 2000 shares of new capital stock of the Fall River Electric Light Company. Par value of this stock is $100, and the commission orders that it be sold at not less than $150 per share. The proceeds are to be applied to the cancellation of obligations represented by promissory notes outstanding since 1909 and to pay for further extensions of the plant.

Penn Central Light & Power Company.—The organization has been completed of the Penn Central Light & Power Company (formerly the Citizens' Electric Light, Heat & Power Company, of Altoona), which is a Pennsylvania corporation and is the result of a physical merger of the following properties: Edison Electric Illuminating Company, of Altoona; Huntingdon Gas Company, of Huntingdon; Mifflin County Gas & Electric Company, of Lewistown, and Lewistown Light, Heat & Power Company, a transmission company with a 45,000-volt high-tension transmission line connecting Lewistown with the hydroelectric plant of the Pennsylvania Hydroelectric Company (formerly the Juniata Water & Water-Power Company, of Warrior Ridge), which will supply all of the power requirements to the lighting company in Lewistown and to the Lewistown & Reedsville Electric Railway Company. All of the common stock of the Penn Central Light & Power Company of Pennsylvania is owned by the Penn Central Light & Power Company of New Jersey, a holding corporation, which likewise owns the stock of the Lewistown & Reedsville Electric Railway Company, of Lewistown, and the stock of the Pennsylvania Hydroelectric Company. The Pennsylvania Hydroelectric Company is the corporation which purchased at foreclosure the property of the old Juniata Water & Water-Power Company and all of its bonds are owned and pledged under the mortgage of the Penn Central Light & Power Company of Pennsylvania. The officers and directors of the Penn Central Light & Power Company of Pennsylvania are: President, R. W. Meirs, of Philadelphia; vice-president, D. A. Pearson, of New York; secretary and treasurer, John E. Zimmermann, of the firm of Dodge & Day, of Philadelphia. Directors: Joseph B. Mayer and George N. Tidd, of New York; George C. Kelchner and Dr. J. N. Sheedy, of Altoona; Henry M. Watts, of the firm of Robert Glendinning & Company, bankers, of Philadelphia, and Beauveau Borie, of the firm of W. N. Newbold's Son & Company, of Philadelphia.

MacKay Companies and Anglo-American Cable.—A statement was published last week that the Mackay Companies had purchased a controlling interest in the Anglo-American Telegraph Company, the cables of which cross from Ireland to Newfoundland, and are operated in connection with the Western Union Telegraph Company. The Mackay Companies already controls the Commercial Cable Company. The Anglo-American Telegraph Company is an English corporation, having a capital of £3,220,770 6 per cent preferred and £558,460 common stock. For years this company has worked in connection with the Western Union, although it is understood that the latter company does not own any considerable amount of stock in the cable company. At the offices of the Mackay Companies in New York no information as to this deal would be given out. It was stated that the only person who was authorized to talk upon the subject was George G. Ward, the vice-president, and that he was at present on his way to Europe.

Interstate Telephone & Telegraph Company.—It has been published at Joliet, Ill., that the American Telephone & Telegraph Company has obtained an option on $2,000,000 worth of bonds of the Interstate Telephone & Telegraph Company out of a total issue of $2,300,000. The Interstate company is an independent concern, which began business twelve years ago, and its lines extend throughout Illinois. C. B. Cheadle, one of the directors of the Interstate company, said that he believes that the holder of this option is the J. P. Morgan syndicate, which recently purchased a number of Ohio telephone properties. He says that the agents acting in the present deal are the same as those acting in the Ohio deal, and that he has been informed that the independent Illinois companies will eventually be connected with the automatic system in Chicago.

Elizabeth & Trenton Railroad Company.—Articles of incorporation have been filed in New Jersey for the Elizabeth & Trenton Railroad Company, which has been organized to take over the trolley line of the Trenton & New Brunswick Railroad Company. The new company will also control the property of the New Jersey Short Line Railroad Company, an extension reaching from New Brunswick to Elizabeth. The authorized capital is $1,200,000, of which $300,000 is 5 per cent cumulative preferred. The Trenton & New Brunswick Railroad Company was sold two weeks ago under foreclosure proceedings. The purchasers were Irvin Shupp, Jr., and Charles Senninkson, who developed the reorganization plan. It has been reported that the Public Service Corporation is interested in the deal.

Massachusetts Electric Companies.—Treasurer Goodspeed, of the Massachusets Electric Companies, is sending letters to various bankers asking bids for the purchase of 5876 shares of preferred stock of the Boston & Northern Street Railway Company, and 4034 shares of the preferred stock of the Old Colony Street Railway Company. Bids will be received until May 26.

New Haven Railroad Earnings.—The New York, New Haven & Hartford Railroad Company is expected to earn a balance of $2,500,000 during its present fiscal year over and above the 8 per cent dividends upon its stock. A large part of these earnings will be derived from dividends from trolley and steamship properties. Earnings from these concerns are now running close to $9,000,000 per year, or 50 per cent of the net earnings of the railroad company. The Connecticut trolleys are operated, it is said, with monthly increases in gross of better than 8 per cent; the Rhode Island trolleys are earning more than 5 per cent on their capitalization, and all of the other properties are showing gains. No new financing is likely to be done until the officials of the road know just what will have to be expended upon construction work. This is as yet uncertain, because the plans for the tunnel between the two Boston terminals, for electrification in Boston and for four-tracking certain portions of the line, have not yet been completed. At a meeting last week held by protesting commuters, who objected to the increase in passenger rates, President Mellen declared that the railroad lost money on every passenger brought into New York City. This, he said, is due to the contract with the New York Central for the use of the terminal tracks, and to the additional expense in carrying passengers on electric trains. He said that the New Haven company intended to electrify the Harlem & Port Chester division immediately.

Anaconda Copper Company.—According to the annual report of the Anaconda Copper Company, made public last week, the total receipts for the 12 months which ended Dec. 31, 1909, amounted to $18,000,084, an increase of $2,395,603. The total net income was $2,134,773, which was equal to 7.12 per cent on the $30,000,000 of capital stock. This compares with earnings last year of 3.61 per cent. In his report to the stockholders, President B. B. Thayer says: "The output of copper during the year 1909, while greater than in the previous year, was appreciably below normal. This was due to causes which the company could not control. In January the railroads, on account of severe weather, were unable to supply a sufficient amount of coke with which to keep the Washoe smelter in full operation, and the mines were compelled to curtail their output. In addition to this, the Anaconda shaft was practically out of commission the greater part of the year, owing to the presence of gas generated by a fire in the workings." The New York Stock Exchange has permitted the listing of $75,000,000 additional Anaconda stock.

United Railways Company of Portland.—John F. Stevens has been elected president of the United Railways Company, of Portland, Ore. This is in line with the plan of James J. Hill to place all of his electric railway properties under one control. Thomas L. Greenough, who was president, has resigned, as has also C. D. Fuller, formerly general manager. L. B. Wickersham has been given the dual position of vice-president and general manager. Mr. Stevens is to be made president of the Oregon Electric Railway Company, and active construction work is to begin at once. Mr. Stevens was formerly vice-president of the New York, New Haven & Hartford Railroad Company and resigned about a year ago to become connected with the Great Northern Railroad.

New York State Railways Company.—Approval has been granted by the Public Service Commission of the Second District of New York of a first consolidated and refunding mortgage given to the Security Trust Company, of Rochester, by the New York State Railways Company. This mortgage is for $35,000,000 at 5 per cent and covers all the property, rights and franchises of the company. The New York State Railways Company is the holding company of the New York Central Railroad for trolley properties in the central part of the state.

Copper Producers' Association.—Col. Thomas L. Livermore, vice-president of the Calumet & Hecla Mining Company, has consented to continue as chairman of the executive committee of the Copper Producers' Association for a few months, or at least until he severs his connection with the mining company. At the May meeting of the Association there was not a word spoken with regard to dissolving the organization or discontinuing the publication of copper statistics.

Hudson & Manhattan Railroad Taxes.—According to a decision rendered in the Supreme Court of New York last week, the assessment of the Hudson & Manhattan Railroad Company upon $8,000,000 worth of property in that state was sustained. The company argued that it was engaged in interstate commerce, and that the state of New York had no dominion over it. This contention was overruled.

West Penn Railway Company.—The stockholders of the West Penn Railway Company, of Pittsburgh, have voted to increase the bonded indebtedness from $6,000,000 to $12,000,000. The new bonds are for improvements and extensions, and will be issued from time to time as needed. The plan whereby the American Water Works & Guarantee Company will assume control of the West Penn Company has been declared operative.

Washington, Baltimore & Annapolis.—The report of the Washington, Baltimore & Annapolis Electric Railway Company for April shows gross earnings of $56,238, as compared with $50,717 for 1909, an increase of $5,520. Net earnings were $26,496, as against $14,581 for last year. The operating expense was reduced from 71 per cent for April of last year to 52 per cent for April of 1910.

Dividends.

American Gas Company, semi-annual, 3½ per cent, payable June 1.

Blackstone Valley Gas & Electric Company, quarterly, 1½ per cent, payable June 1.

Brooklyn Union Elevated Railroad Company, preferred, semi-annual, 2½ per cent, payable June 30; common, initial, 5 per cent, payable June 10.

Brooklyn Union Gas Company, quarterly, 1½ per cent, payable July 1.

General Electric Company, quarterly, 2 per cent, payable June 15.

National Lead Company, quarterly, 1¼ per cent, payable July 1.

Pensacola Electric Company, preferred, semi-annual, 3 per cent, payable June 1.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, quarterly, 1½ per cent, payable June 1.

Southern California Edison Company, quarterly, 1¼ per cent, payable May 16.

United States Motor Company, preferred, quarterly, 1¾ per cent, payable June 15.

Reports of Earnings.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Anaconda Copper Company:					
Year 1909	$18,000,084	$15,990,142	$2,009,942	.....	.....
Year 1908	15,604,481	14,658,518	945.963	.....	.....
Birmingham (Ala.) Railway, Light & Power Company:					
April, 1910	214,835	114,669	100,166	.....	.....
April, 1909	182,667	100,384	82,283	.....	.....
Edison Electric Illuminating Company, of Boston:					
April, 1910	393,600	171,646	221.954	.....	.....
April, 1909	340,568	150,593	189,975	.....	.....
Electric Properties Company:					
Year ended April 30, 1910	239,053	54,062	184,991	$181,775	$3,215
Year ended April 30, 1909	231,188	55,327	175,861	135,669	40,192
Interborough Rapid Transit Company:					
April, 1910	2,564,772	937,045	1,627,727	978,356	622,399
April, 1909	2,421,087	893,201	1,527,886	864,151	593,827
Kings County Electric Light & Power Company:					
April, 1910	342,413	163,260	179,153	62,403	75,552
April, 1909	295,428	144,531	150,897	50,636	66,182
Montreal Street Railway Company:					
April, 1910	344,765	190,842	153,923	49,136	104,787
April, 1909	294,736	170,551	123,822	40,623	83,199
Ontario Power Company:					
April, 1910	56,553	12,089	44,463	42,602	3,756
April, 1909	11,673	32,356	*20.683	26,253	*46,322
Philadelphia Company:					
Year ended March 31, 1910	19,147,517	9,933,336	8,067,909	3,418,668	4,649,241
Year ended March 31, 1909	16,554,593	8,664,860	6.729,978	3,366,572	3,363,406

*Deficit.

General News

Construction News.

BESSEMER, ALA.—The Sloss-Sheffield Steel & Iron Company is reported to be contemplating the installation of an electric plant at its mines in Bessemer. It is proposed to equip the machinery in the mines for electrical operation and also to light the mines with electricity.

CULLMAN, ALA.—Plans are being considered to increase the output of the municipal electric light plant, which will include the installation of additional engines and generators.

PHENIX, ALA.—Arrangements are being made to install an electric pump in connection with the water works system. Electricity for operating the pump will be furnished by the Columbus Railroad Company. For further information address T. W. Briton, Mayor.

TALLADEGA, ALA.—Arrangements have been completed by the Alabama Power & Development Company for the erection of its transmission line from Jackson Shoals to Talladega and from Jackson Shoals to Anniston.

SAFFORD, ARIZ.—S. S. Campbell is reported to have been granted a franchise to construct and operate electric light and water-works systems in Safford, Ariz. The water is to be brought from the Green Mountains by pipe line and electricity to be generated on the route.

DARDANELLE, ARK.—The city is reported to have sold the municipal electric light plant to the Russellville Light & Power Company, and granted the company a franchise to furnish electricity for lamps and motors, generated at its power plant on Illinois Bayou.

HOPE, ARK.—The Hope Metal Frame Screen Manufacturing Company, recently incorporated, is planning to erect a factory, 60 x 120 ft., which will be equipped with wood-working machinery and sheet metal machinery. The company is reported to be in the market for two alternating-current, 60-cycle, 100- to 200-volt, single-phase motors. The present address of the company is 754 Century Building, St. Louis, Mo.

HOT SPRINGS, ARK.—Sealed bids will be received by Major G. D. Deshon, quartermaster, U. S. A., until June 8, for the removal of the present hydraulic elevator in the old administration building, Army and Navy General Hospital, and installation of a new electric elevator in the old hatchway.

ALLEGHANY, CAL.—A. D. Fote, general manager of the Middle Yuba Hydro-Electric Power Company, states that the company expects to be able to supply electricity for the mines of Alleghany early in July. The pole line is being erected from Pike City to Alleghany, which will be used to tap the lines of the Bay Counties Power Company until the Hydro-Electric company has its own plant in operation.

CARRVILLE, CAL.—The Trinity Gold Mining & Reduction Company is contemplating the construction of a 500-hp hydroelectric power plant, utilizing the water power of Coffee Creek to operate the plant. The company is now erecting a 40-stamp cyanide plant.

COVINA, CAL.—Announcement has been made that right of way has been secured for the extension of the Pacific Electric Railway from Covina to San Dimas, a distance of seven miles. It is understood that work will commence on construction of the proposed extension.

LODI, CAL.—The Board of Trustees has engaged H. H. Henderson, engineer, to take charge of the engineering work and construction of the electric light, water works and sewer system in Lodi.

LONG BEACH, CAL.—The City Council has granted the Southern California Edison Company a 21-year franchise to construct and operate three reinforced concrete water-tight conduits, through which water will pass from the ocean to the power house, to be built north of the Salt Lake Bridge. Bids will be received for the franchise until June 17. After the first five years the company is to pay the city 2 per cent of the gross annual receipts arising from the franchise.

LOS ANGELES, CAL.—Orders have been placed by the Board of Public Works with the Allis-Chalmers Company, of Milwaukee, Wis., for 21 440-volt, three-phase, 60-cycle, belted induction motors for use in connection with work on the new water supply aqueduct. Seven of these have a rating of 125 horse-power and the rest range down to 10 horse-power.

LOS ANGELES, CAL.—Negotiations have been closed between the Southern California Edison Coompany, the Los Angeles Dock & Terminal Company, and the San Pedros, Los Angeles & Salt Lake Railroad Company, whereby the first-named company secures approximately 10 acres of ground, west of Long Beach Harbor, on which it will erect a new power plant, which will call for an immediate expenditure of about $2,000,000. Contracts have already been placed for part of the machinery and boilers. The initial installation will have an output of 40,000 hp.

MARYSVILLE, CAL.—Plans are being considered by the Northern Electric Railway Company for the construction of an electric railway from Marysville to Colusa, a distance of about 30 miles.

NEEDLES, CAL.—It is stated that the Victor-Virgin power plant in Needles, which has not been in use for several years, will be put in operation by C. H. Burlock, of San Diego, Cal. The plant will furnish electricity to the Mossack Mines, in the San Francisco mining district.

OAKLAND, CAL.—The Board of Public Works has authorized the installation of electroliers on Twenty-third Avenue, from the railroad track to East Twenty-second Street; 45 electroliers are to be erected. The board has also authorized electroliers placed on Washington Street, between Third and Seventh streets. Six will be placed on each block, each electrolier carrying four lamps.

POMONA, CAL.—The Pomona Valley Telephone & Telegraph Company has purchased the plant and holdings of the Home Telephone Company, of Chino, Cal. The headquarters of the company will be located in Pomona. J. Albert Dole is president and D. S. Parker, secretary and manager.

REDONDO BEACH, CAL.—The contract for the construction of a reinforced concrete boiler room for the Pacific Light & Power Company has been awarded to J. Hall Martin Company, of Los Angeles, Cal., at $28,800. J. G. White & Company are engineers.

SAN FRANCISCO, CAL.—The War Department has instructed the quartermaster-general to take steps to call for bids for the installation of a complete electric lighting system for the Presidio Grounds at San Francisco, Cal.

SAN BERNARDINO, CAL.—Two trust deeds aggregating $2,000,000 have been filed by the Arrowhead Reservoir & Power Company to secure funds for extensions to its system. A large portion of the proceeds will be used for the construction of additional tunnels for draining of distant watersheds into the Little Bear Reservoir and building outlets for power and irrigation purposes. It is expected to have the large dam completed within 18 months.

WATTS, CAL.—At a recent meeting of the Chamber of Commerce a committee was appointed to look into the matter of lighting the city by electricity. The installation of a municipal electric plant has been suggested.

DENVER, COL.—The Denver City Tramway Company is contemplating the purchase of a large Westinghouse-Parsons turbo-generator set.

DENVER, COL.—The sunken gardens at Ninth Avenue and Elati Street are nearing completion and will be opened this summer. The electric lighting system, which was suggested by the architect and landscape gardener, George E. Kessler, of Kansas City, will be a special feature. Twenty-two sprays in the cement pool are lighted by various colored beams, thrown by electric lamps placed under the coping of the wall about the lake.

MAGNOLIA, COL.—The Colorado-Arizona Mines Company is erecting a hydroelectric plant, near Magnolia, Col., and proposes to install a motor-driven hoist and air compressor. The offices of the company are located at 43 Exchange Place, New York, N. Y.

NEW BRITAIN, CONN.—Preparations are being made by the New Britain Machine Company for the erection of an additional building, 60 x 130 ft., five stories high. A new power house will be erected, power facilities increased, and a traveling crane installed.

DELAWARE, DEL.—The City Council has granted the Elk River Light, Heat & Power Company, of Elkton, Md., a franchise to furnish electricity and water in Newark. The company will supply water from the Elk River, for which pipe lines will be built from Elkton to Delaware, a distance of six miles; transmission lines will also be erected for the same distance. The town has operated a municipal electric light and water plant for four years at a loss, and, as the service was inadequate, decided to abandon the plants and secure the service from a private company.

WASHINGTON, D. C.—The Capital Traction Company is reported to have purchased property on the water front, on Front street, between Thirty-first and Thirty-second streets, on which it will erect a power house.

ORLANDO, FLA.—The construction of a municipal electric light plant in Orlando is reported to be under consideration.

COLUMBUS, GA.—Arrangements are being made by the Meritas Mills of Columbus, Ga., for the construction of a new mill, the initial equipment to provide for 10,000 spindles and 170 looms, with provision to increase the capacity to 25,000 spindles and 425 looms. The machinery will be equipped for electrical operation. James T. Broadbent is to be general manager.

DALTON, GA.—At an election held May 14 the citizens voted to issue $120,000 in bonds for public improvements, of which the proceeds of $20,000 will be used for extension of electric light plant.

GRIFFIN, GA.—The Griffin City & Suburban Street Railway Company has been granted a charter by the City Council to construct and operate a street railway system in Griffin.

MACON, GA.—The Central Georgia Power Company is reported to have awarded contracts to the Gresham Manufacturing Company, of Griffin, Ga., for the construction of two substations, one to be located at Griffin and the other at Forsyth, Ga.

GRANGEVILLE, IDAHO.—It is reported that plans are under way for the construction of a power plant on the south fork of the Clearwater River, five miles from Grangeville. The cost of the plant is estimated at $50,000. It is understood that a company will be formed to operate the system. Walter Hovey Hill, of Grangeville, is engineer.

IDAHO FALLS, IDAHO.—Sealed proposals will be received at the office of T. H. Hines, city clerk, Idaho Falls, Idaho, until June 17, for furnishing materials and constructing a hydroelectric plant and pumping station. Plans and specifications, forms for contract and bond may be obtained upon application at the office of the city clerk or Louis C. Kelsey, civil engineer, 402 Dooley Building, Salt Lake City, Utah. A deposit of $15 will be required for plans, which will be refunded upon return of same. E. P. Coltman is mayor.

LEWISTON, IDAHO.—The Columbia Power & Light Company, of Vancouver, Wash., has acquired the Lewiston plant of the Northwestern Corporation. The Columbia company was recently organized to take over part of the holdings of the Northwestern Corporation, in which are included plants at Lewiston, Idaho; Walla Walla, Wash.; Pendleton, Wash., and North Yakima, Wash. The plans of the new company provide for the installation of an electric railway service throughout the territory tributary to the places where the plants are located.

MERIDIAN, IDAHO.—It is reported that plans adopted by the town officials for the water works system call for a motor-driven centrifugal pump and an elevated steel tank of 65,000 gal. capacity.

MOUNTAIN HOME, IDAHO.—Preparations are being made by the Crane Falls Power & Irrigation Company for the construction of a feed canal and head works of its power plant at Crane Falls, on the Snake River, about 15 miles west of Mountain Home. The proposed plant will have an output of about 14,000 hp, which will be utilized principally for lamps and heating purposes in the southwest portion of the State and for pumping water for irrigating lands along Snake River. Arrangements have been made to supply water to irrigate about 10,000 acres in the vicinity of Grand View, Idaho, and the company contemplates irrigating about 10,000 acres additional in the same district in the future. It is also planning to extend its transmission lines into the mining regions of northern Nevada. The project is financed by Canadian capital from Toronto and Montreal. Smith, Kerry & Chace, of Toronto, Ont., Can., are engineers and promoters. It is expected to have the plant ready for operation by the first of the year.

ST. JOE, IDAHO.—A. L. Flewelling has placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 22 x 36 "Reliance" type, heavy duty Corliss belted engine, together with boilers, heater, feed-water pumps, etc.

STITES, IDAHO.—Orders have been placed for an electric power plant to be installed on the Crackerjack mine in the Buffalo Hump district.

CHAMPAIGN, ILL.—The Terminal Power Company has increased its capital stock from $2,500 to $750,000.

CHAMPAIGN, ILL.—The Urbana & Champaign Railway, Gas & Electric Company expects to purchase a 1000-kw, 2300-volt, 60-cycle alternator, a 1500-hp boiler and a Corliss engine with a rating of 1500 hp. H. J. Pepper, of Champaign, Ill., is general superintendent.

CHICAGO, ILL.—Bids are being received by the Aurora, Elgin & Chicago Railroad Company for the construction of a one-story, 47 x 66 ft. brick addition to its boiler house in Batavia. The company is also planning to erect an addition to its substation at Clintonville. E. F. Gould, of Wheaton, Ill., is engineer.

CHICAGO, ILL.—Preparations are being made by the City of Chicago for making extensive additions to its street lighting system. At present the city purchases electricity from the Sanitary District of Chicago for 12,200 lamps, and the Commonwealth Edison Company furnishes 750 lamps. It is proposed to discard the latter service and increase the service of the Sanitary District by 10,000 lamps, making a total of 22,200 arc lamps. The charge of the Sanitary District under the new service will be $29 per lamp, making a total of $643,800 for 22,200 lamps; the interest charges on the proposed bond issue would be about $3 per lamp, making the total cost about $710,000. The total cost of lighting last year was $580,000; lamps furnished by Sanitary District service, including maintenance, was $43 per lamp; service furnished by the Commonwealth Edison, $75 per lamp. The Sanitary District guarantees adequate service and may furnish energy for other purposes after the city's needs are supplied.

FREEPORT, ILL.—The Freeport Casket Company, of Freeport, Ill., recently organized with a capital stock of $100,000, is planning to erect a factory building, 100 x 200 ft., together with power plant, dry kiln and other buildings. The main building will be equipped with a complete line of woodworking machinery, which will be operated by electricity. Plans for factory and power equipment have not yet been completed.

MARION, ILL.—Application has been made to the City Council for a franchise to construct and operate an electric railway in Marion. A. E. Harper is interested in the project.

MARSEILLES, ILL.—Charles A. Munroe, representing the Economy Light & Power Company, of Joliet, Ill., has purchased the Ward water power and holdings in Marseilles. It is understood that the company contemplates an expenditure of about $400,000, developing the water power and property connected with it. The company, it is said, also wishes to purchase the property of the Marseilles Land & Water Company, which owns the water power on the north side of the river.

WAUKEGAN, ILL.—It is reported that the city officials are negotiating with the Economy Light & Power Company, of Joliet, Ill., and the Sanitary District of Chicago, with a view of securing lower rates for electricity for lighting the city. The North Shore Electric Company, of Chicago, Ill., is now furnishing electrical service for the city under a five-year contract, which will expire in October.

BEDFORD, IND.—The Bedford Power Company has awarded the contract for machinery for the auxiliary steam plant to be installed in connection with its hydroelectric power plant at Williams, Ind., to the Allis-Chalmers Company, of Milwaukee, Wis. The equipment consists of two 750-kw, 2300-volt, three-phase, 60-cycle, 3600 r.p.m. steam turbo-generators; one 50-kw, 120-volt, engine-driven exciter; one 55-kw motor generator set and four 500-kva, oil-filled, water-cooled transformers.

CARTHAGE, IND.—Preparations are being made by the United States Board & Paper Company for extensive additions and improvements to its plant, including the installation of a new compound condensing engine, a condensing plant, vacuum plant and considerable electrical equipment.

CRAWFORDSVILLE, IND.—At an election held May 17 the voters approved an appropriation of $100,000 for the erection of a new electric light plant. The total includes $40,000 in the sinking fund of the present plant, and $60,000 to be raised by bond issue. A building will be erected on a new site and equipped with machinery of about 1000 kw output, 60-cycle, three-phase. J. R. Thomas is superintendent.

ELKHART, IND.—The Elkhart Home Telephone Company is negotiating for the purchase of the local plant of the Bell Telephone Company in Elkhart.

ST. JOHN, IND.—The capital stock of the Northwestern Telephone Company has been increased from $10,000 to $25,000, the proceeds to be used for improvements and extensions to its system.

SALISBURY, IND.—The Salisbury Light, Heat & Power Company has contracted with the Allis-Chalmers Company, of Milwaukee, Wis., for a 20 x 36 "Reliance" type, heavy duty, Corliss engine.

SULLIVAN, IND.—Plans have been approved by the Sullivan Electric Company for the remodeling of a large warehouse into an electric light and power plant, bids for which will be called.

COLUMBUS JUNCTION, IA.—Surveys are being made by L. J. Highland, engineer, representing Chicago capitalists, for the construction of a dam in conjunction with a power plant.

DAVENPORT, IA.—Plans have been prepared by the Voss Brothers Manufacturing Company, of Davenport, Ia., for the construction of a new washing machine factory, 75 x 188 ft., which will be equipped for electric motor drive throughout.

DAVENPORT, IA.—The Tri-City Railway Company is planning to build an interurban railway to Muscatine. The company agreed to make the extension if given a 25-year extension of its franchise, which has been granted by the City Council.

JEWELL, IA.—W. H. Grover is reported to have applied for a franchise to construct and operate an electric light plant in Jewell. An election will be held in June to submit the proposition to a vote.

CANTON, KAN.—At an election to be held June 7, the proposition to issue $50,000 in bonds, the proceeds to be used to install an electric light plant and water-works system, will be submitted to a vote.

JAMESTOWN, KAN.—J. A. Borteullanger, of Omaha, Neb., has been awarded the contract for building for the municipal electric plant a transmission line from Concordia to Jamestown, and for erection of distribution lines in the latter place.

McPHERSON, KAN.—It is reported that the municipal electric light and water works station is to be remodeled and new pumping units installed. Other improvements are also contemplated.

SEVERY, KAN.—At an election held May 10, the proposition to issue $8,000 in bonds for the installation of an electric light plant was carried. C. G. Pierce is city clerk.

WICHITA, KAN.—The Chicago, Rock Island & Pacific Railway Company is contemplating the construction of a power plant, roundhouse and repair shops in connection with its new terminals at Wichita, Kan. As yet plans have not been completed.

FRANKFORT, KY.—Steps have been taken by business men of Frankfort and Owenton, Ky., for promoting the construction of an electric railway to connect the two cities. Charles E. Hage, of Frankfort, Ky., is interested in the project.

FARMINGDALE, MAINE.—The Central Maine Power Company has purchased a site on Bowman's Point, in Farmingdale, on which it proposes to erect an auxiliary steam power plant for use in case of low water and emergencies.

OLDTOWN, MAINE.—A special committee has been appointed by the town to look into the question of establishing a municipal electric light plant. For further information address William H. Waterhouse, McLeod Building, Oldtown, Maine.

READFIELD, MAINE.—The Redfield Electric Light & Water Company has been granted a franchise to erect transmission lines in any

part of the town to furnish electricity for lamps, and also to lay pipes from the Nickerson Springs to Readfield to supply water to the residences in this town. The company recently took an option on the old woolen mill property.

YORK HARBOR, MAINE.—The York Electric Light & Power Company, of Biddeford, Maine, has purchased the property of the Agamenticus Light & Power Company, of York Harbor, Maine, of Edward S. Marshall, owner, for $60,000. The York Company now controls the entire electric light and power systems between Biddeford and Dover. It is understood that the company will immediately take steps to light all the shore resorts of Kennebunk, Wells, Ogunquit and York, and the thickly settled portions of these towns. The Selectmen recently awarded a contract for lighting the Town of York to Mr. Marshall, which has been taken over by the York Company, which, it is understood, will make extensions to the service.

ANNAPOLIS, MD.—The Baltimore & Pennsylvania Railway Company has awarded the contract for the construction of its proposed electric railway connecting Baltimore, Hanover and Reisterstown to the Maryland Construction Company.

BALTIMORE, MD.—The Patapsco Electric Light & Power Company, Elliott City, Md., has applied to the City Council for a franchise to erect transmission lines in West Baltimore.

BALTIMORE, MD.—The Board of Awards has awarded the Consolidated Gas, Electric Light & Power Company a contract to supply electricity for a term of one year to light the city hall, court house and annex No. 2. Under the terms of the contract the company will furnish 15,000 kw per month for each building at the rate of 3 cents per kw-hour. Where a less amount is used the cost will be 6, 5 or 4 cents per kw-hour, according to the amount used.

DENTON, MD.—The Struthers Wells Company has placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for a 115-kva, 2300-volt, three-phase, 60-cycle, 900 r.p.m. alternator, together with a 4-kw, 120-volt belted exciter and switchboard.

ATHOL, MASS.—Owing to the excessive rates charged by the Athol Gas & Electric Company the Merchants' Association is contemplating the installation of an electric light plant to furnish electricity in the business district in Athol.

FALL RIVER, MASS.—The Board of Gas and Electric Light Commissioners has granted the Fall River Electric Light Company permission to issue 200 shares of capital stock, to be sold at $150 per share, the proceeds to be used to pay outstanding indebtedness.

ALMA, MICH.—The capital stock of the Union Telephone Company, of Alma, has been increased from $75,000 to $100,000.

DETROIT, MICH.—The Detroit United Railway Company is reported to be contemplating the construction of a railway from Muskegon to Flint, via Bailey and Owosso.

DETROIT, MICH.—It is reported that Benjamin Middleditch, of Detroit, Mich., is in the market for an electrically driven blower and elevator, two motors for cleaning room and one for core room; also for core machines, sand mixers, grinders and other machinery.

OAKWOOD, MICH.—At a special election held May 14 the citizens voted to grant a 30-year franchise to the Detroit Edison Company to furnish electricity for lamps and motors in Oakwood. The Village Council is considering the question of entering into a 10-year contract with the company for street lighting.

OWOSSO, MICH.—The power plant of the Owosso & Corunna Electric Company was badly damaged recently, owing to the racing of the engine.

ALICE (P. O. HIBBINGS), MINN.—The Village Council is reported to be considering the question of establishing a municipal electric light plant, at a cost of $15,000.

BRAINERD, MINN.—It is reported that plans are being prepared by Oscar Clausen, consulting engineer, of St. Paul, Minn., for the installation of an electric light plant. The municipal electric light plant was destroyed by fire in April, causing a loss of about $40,000.

FORT SNELLING, MINN.—Bids will be received until June 11, at the office of the constructing quartermaster, for remodeling the electric light system at Fort Snelling. Plans and specifications and blank proposals may be obtained at the above office. Bids will also be received until June 6, at the same place, for the construction, plumbing, heating, electric wiring and electric fixtures of one four-set officers' quarters, plans and specifications for which may be secured on application. Captain J. M. Campbell is constructing quartermaster.

HIBBING, MINN.—Preparations are being made by the Hibbing Street Railway Company, recently incorporated, for the construction of a street railway in Hibbing, for which application for a franchise will soon be made to the Council. H. C. Hanson is president and J. A. Redfern, of Hibbing, Minn., is secretary of the company.

NORTHFIELD, MINN.—It is reported that the Northfield Light, Heat & Power Company is contemplating extensive improvements to its system.

OWATONNA, MINN.—It is reported that plans have been prepared by F. J. Millar, engineer, of St. Paul, Minn., for an ornamental street illumination system for Owatonna.

RUSHFORD, MINN.—The question of establishing an electric light plant in Rushford is reported to be under consideration.

SAUK CENTER, MINN.—The Northwestern Telephone Exchange Company is contemplating the installation of a new telephone system at a cost of from $25,000 to $30,000.

STILLWATER, MINN.—The Consumers Power Company, of Stillwater, has extended its transmission lines to White Bear, on White Bear Lake, and is furnishing that summer resort with electricity for lamps. The company proposes to extend its lines to serve all outlying and suburban districts, which can be reached from the central station. H. B. Byllesby & Company, of Chicago, Ill., are owners of the property.

VIRGINIA, MINN.—The Park Board is reported to be considering the question of installing curb standard lamps, at a cost of $12,500.

FAYETTE, MO.—The Fayette Electric Light & Power Company, which is operating the municipal electric plant, it is reported, will install a new generating unit with a rating of from 150 to 200 kw., together with auxiliary equipment. The generator will be driven by a Corliss engine.

OSCEOLA, MO.—We are informed that Utt Brothers, 108 La Salle Street, Chicago, Ill., are interested in a project to construct a dam across Osage Run, at a cost of about $200,000. L. J. Highland, of Chicago, Ill., is engineer.

PALMYRA, MO.—We are informed that the city will purchase the local electric light plant owned by the Palmyra Light & Water Company, for which bonds to the amount of $35,000 were recently voted.

ST. JOSEPH, MO.—The Missouri & Kansan Telephone Company has commenced work on extensive improvements and extensions to its plant, which will involve an expenditure of about $200,000 and include the installation of a switchboard and generating apparatus.

ST. LOUIS, MO.—The National Lead Company is making extensive improvements to its plant, including the installation of almost entire new power equipment, the contract for which has been awarded to the Allis-Chalmers Company, of Milwaukee, Wis. The contract calls for two 20 x 42, heavy-duty Corliss engines, one of which will be direct connected to a 250-kw, 240-volt, 110 r.p.m. generator; the other will be provided with a rope fly-wheel for driving shafting; also one 100-kw, 240-volt generator for direct connection to high-speed engine, 14 240-volt motors, ranging from 5 hp to 50 hp, and a six-panel switchboard.

ELM CREEK, NEB.—The Elm Creek Commercial Club is reported to be interested in a project to establish an electric light plant in this town.

MILFORD, NEB.—Preparations are being made for the construction of an electric light plant and water works system in Milford, at a cost of about $20,000. Bids for the construction of the plants will be received about July 1. Martz Brothers, of Seward, Neb., are engineers.

OMAHA, NEB.—The Nebraska Telephone Company has purchased the controlling interest in the Douglass County Telephone Company, of Valley, Waterloo and Elkhorn, independent companies. It is understood that extensive improvements will be made to the system and service. F. A. May is secretary of the Douglas County Telephone Company.

FRANKLIN, N. H.—Plans are being prepared by the Franklin Needle Company for the construction of an electric generating plant.

EDGEWATER, N. J.—Plans are being considered by the New Jersey & Hudson River Railway & Ferry Company for the construction of a one-mile extension to Highwood, and also an extension to Tenafly, a distance of 1½ miles. F. W. Bacon, of Edgewater, N. J., is general manager.

NEW BRUNSWICK, N. J.—The New England Water Power Company has submitted a proposition to the Common Council offering to furnish electricity to the city at the rate of one and one-half cents per kw hour, for power used during the day, provided the city used 150 kw during the term of the contract; the city to erect the distributing system, the cost of which is estimated at $40,000, making the annual cost of each lamp not over $45 per year. It also agrees to supply a customer to use the poles at an annual rental sufficient to pay the entire interest charge upon the cost of the distributing system. The city now pays the Public Service Company of New Jersey $95 each per year for arc lamps. The lighting committee recommended that a 24-hour contract be made, using the energy during the day to operate the water-works system; also that an engineer be engaged to prepare plans for necessary changes at the pumping station and for distribution system.

TRENTON, N. J.—The property of the Trenton Water Power Company has been purchased by a new corporation of which David Wharton Pepper, Jr., of Philadelphia, Pa., is the head. The new company contemplates the construction of a power plant at once along the Delaware River for the purpose of supplying power to manufacturing establishments. It is proposed to equip the new plant so that the company can furnish water, steam or electrical power. It is proposed to furnish water power to plants along the river and electric and steam power for plants located at a distance where power will have to be transmitted.

MONTICELLO, N. M.—Surveys are being made for the Black Range Reduction Company in the vicinity of Monticello, in connection with construction of a power plant. It is proposed to install a plant with an output of 200 hp, to be transmitted to the properties of the company, in the north end of the district.

PORTALES, N. M.—The municipal electric light plant and water pumping station has just been put in operation. The equipment includes gas producers and gas engines supplied by the Fairbanks-Morse Company and General Electric generators. The plant will furnish electricity for lamps and motors in Portales and also to operate small pumping plants for the irrigation of a large district surrounding Portales.

ALBANY, N. Y.—Preliminary plans have been prepared by Franklin B. Ware, state architect, for the new power house to be erected by the State at North Hawk and Orange Streets and Sheridan Avenue.

BINGHAMTON, N. Y.—The city is reported to have engaged A. D. Adams, of Worcester, Mass., to make a report on the development of the Susquehanna River; also the cost and operating expenses of an electric plant for municipal lighting.

BROOKLYN, N. Y.—Plans are being prepared by the Edison Electric Illuminating Company to enlarge its Gold Street power house, at a cost of about $100,000. It is proposed to erect a four-story brick addition, estimates for which will probably be received about June 25.

BUFFALO, N. Y.—The Buffalo Crushed Stone Company, of Buffalo, N. Y., is reported to be contemplating the installation of an alternating-current motor of from 250 to 300 hp, to drive a large rock breaker.

LOCKPORT, N. Y.—The contract for street lighting has been awarded by the City Council to the Lockport Light, Heat & Power Company for one year, at the rate of $55 per lamp per year. The Conant-Bryant Power Company submitted a bid offering to furnish lamps at $52.50 each year per year on a three-year contract, but failed to enclose check to bind the same.

MASSENA, N. Y.—The St. Lawrence River Power Company is contemplating the construction of a concrete dam on the canal connecting the St. Lawrence and Grasse rivers, in Massena, for which it is said a contract will soon be awarded. The dam will be about 400 ft. long and 30 ft. high, and under the terms of the contract is to be completed about Dec. 1. The cost of the work is estimated at about $300,000. The company is now installing new turbines to replace the ones now in use, increasing the output of the plant by 6000 hp.

NEW YORK, N. Y.—The Board of Aldermen has adopted the ordinance directing the Board of Estimate and Apportionment to authorize the controller to issue special revenue bonds to the amount of $56,200, the proceeds to be used for the purpose of installing additional lamps throughout the city.

NEW YORK, N. Y.—Bids will be received until May 31 by C. B. J. Snyder, superintendent school buildings, for completing and finishing repairs, alterations and additions to the electric equipment in Public School 4, Fulton Avenue and 173d Street, Borough of Bronx, in accordance with the original plans and specifications of contract awarded to E. J. Duggan, which has been declared abandoned.

RIVERHEAD, N. Y.—The Public Service Commission, Second District, has authorized the Hallett Light & Power Company to transfer all franchises, property and systems to the Riverhead Light & Power Company, and has authorized the Riverhead Company to acquire and hold such franchises, property, etc. The Riverhead Electric Light Company is authorized to pay for the franchises, properties, etc., by recalling all of its capital stock now outstanding, amounting to $7,500, and to issue new stock to the amount of $6,000, of which $3,000 shall be issued to the stockholders of the Riverhead Electric Light Company, and the remaining $3,000 to the Hallett Light & Power Company.

ROCHESTER, N. Y.—The Public Service Commission, Second District, has given its approval of the form of a first consolidated and refunding mortgage to the Security Trust Company, of Rochester, N. Y., by the New York State Railways upon all its property, rights and franchises to secure issues of $35,000,000 in bonds.

SENECA FALLS, N. Y.—The Public Service Commission, Second District, has denied the application of the Geneva & Auburn Railway Company for permission to issue $50,000 in preferred stock.

UTICA, N. Y.—The Utica & Mohawk Valley Railway Company is contemplating the construction of several extensions to its railway system in Rome.

GREENSBORO, N. C.—John A. Hodkin, of Greenboro, N. C., informs us that he owns an excellent water power which he would like to sell. It is estimated that 4400 hp could be developed and delivered to Greensboro, N. C., at a cost of about $18,000.

BEACH, N. D.—It is reported that George Chrysler is contemplating the construction of an electric light plant in Beach, work on which will commence in the near future.

ATHENS, OHIO.—Sealed proposals will be received by the Board of Trustees of the Ohio University, Athens, Ohio, until June 16, for furnishing materials and construction of addition to power house and building new smokestack; also for new boilers, feed pumps, vacuum pumps and for piping and radiators in Ellis Hall, in accordance with plans and specifications on file at the office of I. M. Foster, secretary of board of trustees, and at the office of Frank L. Packare, architect, New Hayden Building, Columbus, Ohio. Proposals must be made out on blanks furnished by the architect or the secretary of the board. Alston Ellis is president of the board.

CLEVELAND, OHIO.—The Cleveland Railway Company, it is said, will apply at the next meeting of the City Council for a franchise to establish a crosstown line on West Sixty-fifth Street, which will extend eventually to Ridge Road to West Park Cemetery. It is understood that the franchise will be granted.

COLUMBUS, OHIO.—The contract for switchboard and connecting cables for the power house at the Ohio State Prison was awarded to the Simonton Construction Company, of Columbus, Ohio, for $3,439.

DAYTON, OHIO.—Preliminary surveys have been completed by the Dayton, Springfield & Xenia Southern Railway Company for its proposed electric railway extending from Xenia to Washington.

TOLEDO, OHIO.—It is reported that the Cincinnati, Hamilton & Dayton Railroad Company is planning to install a rotary converter with a rating of from 600 to 800 kw, and other equipment, including a direct-current generator with equalizing flywheel, on its docks at Toledo.

WOODVILLE, OHIO.—The Lemoyne Telephone Company has increased its capital stock from $10,000 to $25,000.

ENID, OKLA.—The Enid Gas & Electric Company has filed amendments to its charter changing its name to the Garfield County Gas & Electric Company. The company is capitalized at $200,000.

CRESWELL, ORE.—The Town Council has granted John Tunnel a franchise to erect transmission lines for the distribution of electricity for lamps in Creswell.

EUGENE, ORE.—The Portland, Eugene & Eastern Railway Company has submitted a proposition to the Northwest Eugene Improvement Club, offering to extend its system to the western end of the city for a bonus of $12,000.

FOREST GROVE, ORE.—The City Council is contemplating the installation of a new boiler and engine of 160 hp in the municipal lighting plant, for which bids have been authorized.

MADRAS, ORE.—Amme & Garraw, of Portland, Ore., electrical engineers, have communicated with the City Council in reference to securing a franchise to construct and operate an electric light and power system in Madras.

MARSHFIELD, ORE.—The City Council has granted the Coos Bay Rapid Transit Company a franchise to construct and operate a street car line in Marshfield. Under the terms of the franchise the company is to pay the city 1 per cent of its gross earnings after the population has reached 35,000. The Council has also granted a franchise to J. M. Blake for an electric railway in Marshfield, but on different streets.

NORTH BEND, ORE.—It is reported that a company has been organized to construct an electric railway from North Bend to Marshfield, Ore. L. D. Kenny, of North Bend, Ore., is reported to be interested in the project.

ONTARIO, ORE.—Application has been made to the City Council by A. N. Sorliss, representing Henry Hewitt, of Spokane, Wash., for a franchise to construct and operate a street railway in Ontario. It is stated that the proposed railway would connect at Snake River, near Nyssa, with the Pierce railway to Caldwell. It is reported that the Idaho-Oregon Light & Power Company also contemplates extending its interurban lines, and will ask for a franchise in Ontario; the Ox Bow power line will furnish the service.

STAYTON, ORE.—It is reported that the Stayton Electric Light Company is contemplating the installation of a steam-power plant during the coming summer, to provide for the high-water period during the winter. The plant was obliged to shut down last winter, owing to its power dam being washed away.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until June 8, for furnishing steel, iron, bronze, copper, steel and copper tubing, wire cable, etc., as per circular No. 585. Blanks and general information relating to the above circular may be obtained at the above office or at the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 55 National Realty Building, New Orleans, La.; and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing agent.

ERIE, PA.—The Erie Forge Company, of Erie, Pa., is reported to have placed orders for a 175-kw, direct-current generating unit to furnish electricity to operate its plant.

LANDISBURG, PA.—The capital stock of the Perry County Telephone and Telegraph Company has been increased from $6,000 to $20,000. N. K. Bristlin, C. E. Beck and E. L. Ernest are interested in the company.

NEW CASTLE, PA.—The stockholders of the Mahoning & Shenango Valley Railway & Light Company have authorized an increase in the capital stock of the company from $10,000,000 to $11,000,000, the proceeds to be used to take care of the increasing demands on the company.

NEWPORT, PA.—Plans are being prepared to double the output of the hosiery mill of H. A. Romberger in Newport, which will include the erection of an addition to the present mill and dye house. The equipment will include a 100-hp Corliss engine, two 100-hp horizontal boilers, two electric generators, two electric motors for direct current, and dyeing machinery.

ORBISONIA, PA.—The Orbisonia Telephone Company has filed a notice of increase of capital stock from $10,000 to $20,000.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia & Reading Railway Company in the Bureau of Building Inspection for approval of the erection of a large power house on Pier 14, North Wharves, in Port Richmond, to furnish power to operate the machinery in the coal pockets of the company at that place. William Hunter, of Philadelphia, Pa., is chief engineer.

PHILADELPHIA, PA.—Plans are being considered by the Philadelphia Rapid Transit Company for extensive improvements and extensions to its system in North Philadelphia and suburbs beyond, which will

include the construction of a large power plant at Germantown and Erie Avenues, the cost of which, including equipment, is estimated at $100,000. Under the present plans the building will be erected by the Philadelphia Hydro-Electric Company and applied to the use of the Philadelphia Rapid Transit Company.

PITTSBURGH, PA.—Plans are reported to have been completed by the West Penn Railways Company for the construction of an extension from Greensburg to the Jamison Coke Works, and thence to Latrobe, 10 miles in length. The company also proposes to build an extension to West Newton and Hunkers during the coming summer. W. E. Moore, of Connellsville, Pa., is general manager.

FORT ADAMS, R. I.—The contract for constructing extensions and remodeling the underground electrical distributing system at Fort Greble, R. I., has been awarded to the Whitall Electric Company, of Westerly, R. I., for $2,800.

ABBEVILLE, S. C.—The construction of an electric railway extending from Abbeville to Greenville, S. C., is under consideration. J. S. Stark, R. E. Cox, of Abbeville, S. C.; R. C. Brownlee and Dr. Jesse Bell, of Due West, S. C., are interested in the project.

GREAT FALLS, S. C.—The Allis-Chalmers Company, of Milwaukee, Wis., has been awarded contract for the electrical equipment for the Republic Cotton Mills now being constructed. The contract calls for 22 20-hp, 12 10-hp and one 5-hp, squirrel-cage induction motors; one 125-hp, two 100-hp, two 75-hp and one 50-hp, wound rotor, induction motors; three 200-kva, 2200-600-volt, oil-filled, self-cooled transformers; two 25-kva, 2100-105-volt transformers and an 11-panel switchboard. All machinery will be driven by electric motors, the four-frame drive being employed. Electricity for operating the mills will be supplied by the Southern Power Company.

BRISTOL, TENN.—Negotiations have been closed whereby the Bristol Belt Line Railway Company has purchased the Halston Valley Railroad, which has been operated as a lumber road between Bristol and Holston Mountain. It is understood that the Bristol company will equip the railroad for electrical operation.

CHATTANOOGA, TENN.—Bids will be received by the Board of Public Works, Chattanooga, Tenn., for furnishing and installing two centrifugal pumps with electric motors, shafting and automatic starting and stopping devices. Blank forms for proposal and specifications furnished on application to Robert Hooke, city engineer.

JOHNSON CITY, TENN.—The City Council has granted the East Tennessee Telephone Company a franchise to construct and operate a telephone system in Johnson City, Tenn.

ATLANTA, TEX.—A company is reported to have been formed, with a capital stock of $20,000, for the purpose of operating an ice plant in connection with the present electric light plant. Orders for machinery have already been placed. A day electrical service will be established for fans.

DALHART, TEX.—The Trans-Canadian Telephone Company has awarded a contract for the construction of a telephone system in Dalhart. The common battery system will be installed and will cost about $25,000. Allen Spain is engineer in charge. D. O. Hazleton is manager.

DALLAS, TEX.—The contract to complete the work on the lock and dam No. 6, on the Trinity River, has been awarded to J. G. White & Company, of New York, N. Y., at $85,000.

EL PASO, TEX.—The reclamation engineers in El Paso have received instructions from the Government at Washington to proceed at once with the work on construction of the Elephant Butte dam. The cost of the work is estimated at about $9,000,000 and will require nine years to complete it. The dam will irrigate 225,000 acres and will fulfill a treaty obligation with Mexico furnishing water for irrigating as much land as the Mexicans cultivated prior to the interference with the waters of the international boundary stream by the diversion of water in Colorado. Work has been delayed owing to condemnation proceedings for the land needed for the 40-mile lake to be formed by the dam.

SNYDER, TEX.—Plans are being considered by the Snyder Ice, Light & Power Company for enlarging its plant. It is understood that negotiations are under way for the purchase of new machinery. R. F. Brumbach is interested in the company.

SPUR, TEX.—Arrangements are being made by E. P. Swenson, of Spur, to install an electric light plant in this town, contract for construction of which has been awarded to J. E. Johnson, of Stamford, Tex.

NEPHI, UTAH.—The citizens have voted to issue $15,000 in bonds to build a new electric light plant, to meet the increasing demand for electrical service.

PROVO, UTAH.—The City Council has engaged Louis C. Kelsey, of Salt Lake City, Utah, as consulting engineer in connection with the construction of its proposed hydroelectric power plant, to cost approximately $110,000, and water-works system, the cost of which is estimated at $90,000.

ALEXANDRIA, VA.—The laying of the electric cable across the Potomac River between Fort Washington and Fort Hunt has been completed. The new cable will be used for the transmission of electricity to light the buildings and grounds at Fort Washington. The posts have been lighted by independent plants since they were established about 10 years ago. The Alexandria Electric Lighting Company has recently secured the contract to furnish electrical service at Fort Hunt and Fort Washington to be furnished from the central station at Alexandria. As soon as the new system is installed the power plants at the forts will be put out of commission, but will be held in readiness for use in emergencies.

BEDFORD CITY, VA.—The contract for construction of the municipal hydroelectric plant on the James River is reported to have been awarded to Francis R. Weller, 723 Fifteenth Street, N. W., Washington, D. C. Under the terms of the contract Mr. Weller will furnish complete plans and specifications, make surveys at dam, select site, make surveys for transmission line between the dam at James River and Bedford City, and remodel the present electric plant. Bonds to the amount of $100,000 were recently voted for the work.

BROOKNEAL, VA.—The installation of an electric light plant in Brookneal is reported to be under consideration. Elder & Overacre, of Lynchburg, Va., are reported to be interested in the project.

FREDERICKSBURG, VA.—The contract for power plant for Normal and Industrial School for Women, at Fredericksburg, Va., has been awarded to J. W. Sargent, of Richmond, Va.; heating and vacuum cleaning systems to W. P. Longworth & Company, of Richmond, Va.; electric wiring to Harrison & Montague, of Fredericksburg, and water system to Sydnor Pump & Well Company, of Richmond, Va.

LANGLEY, WASH.—A. Melson and H. P. Jensen, of Langley, Wash., are reported to have purchased the plant of the Langley Manufacturing Company. The new owners, it is said, will make some improvements, including the installation of an electric generating set.

SEATTLE, WASH.—Estimates of the cost of installing cluster lamps on several streets have been submitted to the Board of Public Works by R. H. Thomson, city engineer, as follows: Westlake Avenue, $14,000; Stewart Street, $9,600, and Third Avenue, $21,000.

SEATTLE, WASH.—The Columbia Valley Reclamation Company has secured a tract on the Columbia River, at Priest Rapids. It is understood that the company proposes to install a power plant near the rapids, with an output of from 40,000 to 50,000 hp, to elevate the water for irrigation purposes. R. G. Strahorn, of Spokane, Wash., is interested in the project.

SEATTLE, WASH.—Preparations are being made by the Schwager-Nettleton Mills for the construction of large lumber mills to be equipped for electric motor drive. Orders have been placed with the Allis-Chalmers Company, of Milwaukee, Wis., for both saw mill and power equipment, including a 750-kva, 480-volt, three-phase, 60-cycle, 3600 r.p.m. steam turbo-generator set, a 35-kw, engine-driven exciter unit, two 15-kva, lighting transformers, to reduce the voltage from 440 to 110 volts, and a switchboard; also 24 motors, varying in size from 200-hp to 25-hp.

SPOKANE, WASH.—Orders have been placed by Thaddeus S. Lane, president of the Interstate Telephone Company, for equipment for the telephone system in Spokane, involving an expenditure of about $250,000. Orders have also been placed for new switchboards to be installed in exchanges in the Montana towns at a cost of about $100,000. The company is also erecting a long-distance line from Butte, Mont., to Spokane, Wash.

CLARKSBURG, W. VA.—Surveys are being made for the proposed electric railway of the Buchannon & Clarksburg Traction Company from Buchannon to Clarksburg, a distance of 30 miles. It is expected that work will soon begin on the construction of the railway.

GRAFTON, W. VA.—Work will soon commence on the construction of the new power plant of the Grafton Gas & Electric Company on the south side of the city. The new plant will furnish electricity to operate the cars of the Grafton Traction Company, as well as for lamps and motors.

MORGANTOWN, W. VA.—Plans are being considered by the South Morgantown Traction Company for an extension of its street railway system across Chancery Hill into South Park, and thence to Marilla.

WHEELING, W. VA.—The Consumers' Electric Company has purchased a site at the corner of Forty-third and Water Streets, on which it proposes to erect a new power plant, the cost of which is estimated at about $250,000.

WHEELING, W. VA.—The Wheeling Traction Company is contemplating the installation of additional equipment in its plant, including one 1875-kw, low-pressure turbine, two 500-kw motor-generator sets, with necessary switchboards and two motor-driven centrifugal pumps, with condensing apparatus, etc.

EAU CLAIRE, WIS.—Preparations are being made by the Wisconsin Telephone Company for improvements to its system in Eau Claire and Chippewa Falls, at a cost of about $15,000.

EVANSVILLE, WIS.—The Baker Manufacturing Company has recently placed an order with the Allis-Chalmers Company, of Milwaukee, Wis., for an 18 x 36 "Reliance" type, heavy duty, Corliss engine, belted to a 200-kva, three-phase, 60-cycle, 600-r.p.m. alternator. Excitation will be supplied by a 9-kw belted unit. The order also includes a 20-hp, squirrel-cage induction motor.

KENOSHA, WIS.—Charles Skidd, of Kenosha, Wis., is reported to be contemplating the construction of a three-story factory, for which an electric generator, a steam generating plant of 150 hp, and some motors will be required.

KENOSHA, WIS.—The Kenosha Electric Railway Company has applied to the Wisconsin Railway Commission for a certificate of con-

venience and necessity for a franchise to engage in a general lighting business in the city of Kenosha.

MERRILL, WIS.—The Merrill Railway & Lighting Company is reported to have taken over the electric light business of the H. W. Wright Lumber Company, and also to have purchased the distributing system of the lumber company.

OCONTO, WIS.—The Oconto Rural Telephone Company is contemplating extensions to its telephone system, taking in many towns of Oconto County. George Glynn is president of the company.

RACINE, WIS.—Preparations are being made by the Kelley-Racine Rubber Company, of Racine, Wis., for the construction of a new factory, 100 x 375 ft. It is understood that the company will require a large line of mechanical and electrical power equipment for the plant.

WEST ALLIS, WIS.—The Wehr Steel Company, of Milwaukee, Wis., is reported to be preparing plans for the construction of a new foundry, which will be equipped for electric motor drive. Electricity for operating the plant will be furnished by a generator driven by a gas engine.

WEST SALEM, WIS.—The Neshonoc Light & Power Company is contemplating a complete renovation of its plant.

CHEYENNE, WYO.—Bids will be received at the office of the construction quartermaster, Cheyenne, Wyo., until June 8 for the construction, plumbing, heating, electric wiring and electric fixtures for buildings at Fort D. A. Russell, Wyo., as follows: (1) For one quarters for four civilian employees, plans No. 82-P; (2) for one quartermaster's stable, plans No. 139-L, and two stables, plans No. 139-Q; (3) for one double stable guard and shop building, plans No. 39-Q; (4) for one wagon shed, construction only, plans No. 60-H; (5) for the installation of steam heating systems complete and alterations in construction of barracks Nos. 35, 36, 37, 39, 40, 41, 42, 43 and 44, post plans, plans No. 2-993, and officers' quarters, Nos. 29 and 30, post plans. Plans and specifications for the inspection of bidders are on file at the above office, also in the offices of the chief quartermaster, Department of Missouri, Omaha, Neb.; chief quartermaster, Department of Colorado, Denver, Col.; depot quartermaster, St. Louis, Mo.; constructing quartermaster, Fort Leavenworth, Kan., and secretary of Builders' Exchange, St. Paul, Minn. Captain V. K. Hart, assistant quartermaster, is in charge of construction.

MEDICINE HAT, ALTA., CAN.—A by-law to appropriate $70,000 for the construction of a municipal electric light plant in Medicine Hat will soon be submitted to the ratepayers.

MERRITT, B. C., CAN.—The Merritt Electric Light & Water Company is reported to have decided to install an electric lighting system, the cost of which is estimated at about $15,000.

BOWMANVILLE, ONT., CAN.—A by-law to purchase the local electric light plant for $12,000 will be submitted to a vote on May 31.

INGERSOLL, ONT., CAN.—The City Council has passed by-laws to take over the local electric light plant at $39,800, and to make extensions to the water-works system to cost about $55,000.

KINGSTON, ONT., CAN.—The Board of Trade is considering the question of securing cheaper power for Kingston. The Northumberland & Durham Power Company claims that it can reduce the cost of electricity to the city by one-third.

NEW HAMBURG, ONT., CAN.—A by-law will be submitted to the ratepayers to purchase the local electric light plant, owned by Jacob Morley, to be operated by the municipality in connection with the proposition of the Ontario Hydro-Electric Power Commission.

TORONTO, ONT., CAN.—The Toronto Railway Company has submitted to the Ontario Railway and Municipal Board for approval a list of several new street car lines the company has agreed to build in Toronto.

OCAMPO, CHIHUAHUA, MEX.—J. R. Darrach, of El Paso, Tex., who is operating the Santa Librada group of gold mines, near Ocampo, under lease, is contemplating the installation of a 300-hp electric power plant. Electricity will be transmitted 10 miles to the mines.

PACHUCA, MEX.—The new electric railway of the Pachuca & Real del Monte Mining Company, connecting the Rosario Mine with the Loreto Hacienda, will soon be completed. The company is now making arrangements to build another electric railway to extend from the Real del Monte property to Pachuca, via El Chico.

PACHUCA, MEX.—Announcement has been made that the Mexico Light & Power Company expects to have its transmission line completed and ready to furnish electrical service to the Pachuca mining district about July 1. Many contracts have been placed by the different mines and industrial companies. It is expected that the demand will exceed the supply. The company expects to have about 30,000 hp available for this district.

PARRAL, CHIHUAHUA, MEX.—E. Lindblom has obtained a concession from the State Government for the installation of an electric light and power plant and telephone system in Parral, for a period of 10 years. Exemptions from state and municipal taxes during the entire term are provided for in the concession.

SAN LUIS POTOSI, MEX.—The plant and holdings of the Potosina Electric Company have been purchased by the Central Mexico Power Company, a subsidiary of the Guanajuato Power & Electric Company. The present plant has an output of 1000 hp, and it is planned to supply 5000 hp additional, if needed. The Guanajuato Power & Electric Company is already operating two hydroelectric plants, one on the Duero River and the other on the Angulo River, with a combined output of 10,000 hp. The company is erecting a third hydroelectric plant, which will generate 10,000 hp. It also has a working agreement with the Chapala Hydro-Electric & Irrigation Company, which is developing a large amount of power in the vicinity of Guadalajara.

SANTA ROSALIA, CHIHUAHUA, MEX.—Arrangements are being made for the construction of the large dam across the Conchos River at Boquilla, 17 miles from Santa Rosalia, work on which will begin within a few weeks. The dam will provide power for the hydroelectric plant to be installed by the Mexican Northern Power Company. It is expected to have the plant completed in about 18 months. S. Pearson & Son, Ltd., are the contractors.

TEPIC, MEX.—A. R. Springer and associates, it is stated, are contemplating the construction of a hydroelectric power plant in the territory of Tepic, for the purpose of supplying electricity for mines and other industries in this vicinity. It is proposed to develop the water power of the Acosta and Chichicaste arroyos.

New Industrial Companies.

THE AMERICAN ROTARY MACHINE COMPANY, of Hartford, Conn., has been incorporated with a capital stock of $2,000,000 for the purpose of acquiring certain letters patent covering Wilheim Pittler's system of rotary engines and machines, with a view of carrying into effect an agreement which was entered into between the International Rotations-Maschinen Gesellschaft, of Berlin, and Armistead Keith Baylor, of London. The incorporators are: A. K. Baylor, of London, Eng.; E. M. Sairtello, of Englewood, N. J., and James H. Byrne, of New York, N. Y.

THE AUTOMOBILE LIGHTING COMPANY, of Springfield, Mass., has been incorporated with a capital stock of $30,000 to deal in automobile apparatus. The officers are: H. W. Field, of Leverett, Mass., president; Matthew N. Ryan, of Hatfield, Mass., vice-president, and C. P. Lyman, of Holyoke, Mass., treasurer.

THE BLAIR ENGINEERING COMPANY, of Chicago, Ill., has been chartered with a capital stock of $100,000 by Roswell F. Mundy. The company proposes to do a general construction business.

THE CAHILL MUSIC MACHINERY MANUFACTURING COMPANY, of Jersey City, N. J., has been chartered by E. H. Jackson, G. F. Cahill, A. T. Cahill and T. Cahill, of Jersey City, N. J. The company is capitalized at $500,000 and proposes to manufacture electric-music generating and distributing machinery.

THE CALDWELL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 for the purpose of doing a general engineering and contracting business. The incorporators are: Samuel W. Norton, R. Olmstead, Samuel Bothblum and S. W. Norton, 1420 Ashland Block, Chicago, Ill.

THE DEYO-MACEY ENGINE COMPANY, of Binghamton, N. Y., has been chartered with a capital stock of $100,000 to manufacture and deal in gas and gasoline motors, engines, etc. The incorporators are: R. Herbert Deyo, Frank T. Macey and Isreal T. Deyo, of Binghamton, N. Y.

THE DYETT TOOL & ENGINEERING COMPANY, of Ilion, N. Y., has been incorporated by F. J. Dyett, B. B. Ross and A. L. Johnson, of Ilion, N. Y. The company is capitalized at $100,000, and proposes to manufacture tools, engines, boilers, machinery, etc.

THE DULLESS-BALDWIN ELECTRIC DRILL COMPANY, of Kerhonkson, N. Y., has been incorporated by J. H. Baldwin, F. P. Darter and E. T. Magoffin, of New York, N. Y. The company is capitalized at $600,000 and proposes to manufacture and deal in drilling machinery, etc.

THE DYETT TOOL & ENGINEERING COMPANY, of Ilion, N. Y., has been incorporated with a capital stock of $100,000 by F. J. Dyett, B. B. Ross and A. L. Johnson, of Ilion, N. Y. The company proposes to manufacture tools, engines, boilers, machinery, etc.

THE ELECTRIC REVOLVING SIGN MANUFACTURING COMPANY, of Birmingham, Ala., has been chartered by A. L. Campbell, J. T. Moncrief, T. T. Dison, P. Sharmon, J. N. Campbell and W. H. Wright. The company is capitalized at $25,000 and proposes to manufacture and operate electrical signs for advertising purposes.

THE FACKNER-COATES CONSTRUCTION COMPANY, of Brooklyn, N. Y., has been incorporated by Edward Fackner, 744 Carroll Street; Charles B. Coates, 496 Mansfield Place, both of Brooklyn, N. Y., and Charles B. Sager, of Richmond Hill, N. Y. The company is capitalized at $40,000, and proposes to do real estate, general contracting, mining, civil, electrical and sanitary engineering business.

F. V. SMITH & SON, Inc., of New York, N. Y., have filed articles of incorporation with a capital stock of $5,000 for the purpose of doing a general contracting business. The incorporators are: F. Vinton Smith, John J. Donnocan, Edmund J. O'Connor, all of New York, N. Y.

THE GALVA HEATER COMPANY, of Galva, Ill., has been incorporated by E. L. Yocum, C. M. Lyford and H. A. Smith, of Cambridge, Ill. The company is capitalized at $30,000 and proposes to manufacture boilers and heaters.

H. N. ROTHWELLER & COMPANY, of Seattle, Wash., have been chartered with a capital stock of $10,000 by H. N. Rothweller, D. R. McKay and Frank H. Foster. The company proposes to deal in machinery for power plants, etc.

THE INDUSTRIAL ENGINEERING COMPANY, of Portland, Ore., has been incorporated with W. C. Alvord, E. H. Corbett and J. H. LaMoree.

THE JOHN D. MOYNEHAN CONTRACTING COMPANY, of Mohawk, N. Y., has been chartered with a capital stock of $25,000 by J. Anderson, Jr., P. Tummins, of Newcomb, N. Y., and D. Moynehan, of Mohawk, N. Y. The company proposes to do a general contracting business, building public and private works.

THE MERCURY MOTOR COMPANY, of Chicago, Ill., has filed articles of incorporation, with a capital stock of $200,000, for the purpose of manufacturing machinery. Sidney A. Cryor is interested in the company.

THE MOORE ELECTRICAL & AUTOMOBILE COMPANY has filed articles of incorporation with a capital stock of $50,000. The incorporators are: R. E. Moore, E. R. Pusey and E. Moore, Jr., of Wilmington, Del.

THE MUNICIPAL ENGINEERING & CONSTRUCTION COMPANY, of Chattanooga, Tenn., has been organized for the purpose of designing and constructing power plants, pumping stations and water and sewerage systems.

THE NEW YORK ROTARY ENGINEERING & ACCESSORIES MANUFACTURING COMPANY, of New York, N. Y., has been incorporated by D. Davis, H. Katz and C. M. Lackland, Jr., of New York, N. Y. The company is capitalized at $50,000 and proposes to manufacture motors, engines, taximeters, etc.

THE PALMER A. HART COMPANY, of Morrisville, N. Y., has filed articles of incorporation with a capital stock of $35,000 for the purpose of doing a general construction business. The incorporators are: P. A. Hart, of the Bronx; M. F. Huse, of Mt. Vernon, N. Y., and H. Keehn, of Paterson, N. J.

THE STANDARD CLEANER COMPANY, of Chicago, Ill., has been chartered with a capital stock of $50,000 by L. C. Bonney, D. A. Roberts and F. Posvic, of Chicago, Ill. The company proposes to manufacture cleaning devices.

THE STAR CONSOLIDATED GENERATOR COMPANY, of Portland, Maine, has been chartered with a capital stock of $500,000 by C. E. Eaton, T. L. Croteau and J. E. Manter, all of Portland, Maine. The company proposes to deal in electrical and mechanical devices.

THE UNIVERSAL WIRELESS TELEGRAPH SUPPLY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by Bernard L. Kamen, M. G. Bender and David C. Munson, of New York, N. Y. The company proposes to manage and regulate wireless telegraph business and to manufacture and deal in telegraph and telephone supplies.

New Incorporations.

SAN FRANCISCO, CAL.—The Cutler National Electric Heater Company has filed articles of incorporation, with a capital stock of $10,000, by L. Papineau, W. F. Cutler, D. M. Carmel and F. and G. Mandelbaum.

SAN FRANCISCO, CAL.—The Pacific Power Company has filed articles of incorporation with a capital stock of $1,000. The company proposes to acquire watersheds and water courses. The incorporators are: James McNab, George W. Hendry and A. E. Anderson.

CHICAGO, ILL.—The Subway Telephone Construction Company has been chartered with a capital stock of $100,000 by Joseph Harris, Sanford F. Harris and Albert E. Wilson. The company proposes to construct and operate telephone and telegraph lines.

EMMETSBURG, IA.—Articles of incorporation have been filed for the Postville Light & Heat Company, with a capital stock of $25,000.

WEST LIBERTY, KY.—The Morgan County Heat, Fuel & Light Company has been chartered with a capital stock of $25,000 by S. R. Collier, W. G. Blair, C. W. Comack, W. M. Gardner, H. M. Cox and W. M. Kendall.

AUGUSTA, MAINE.—The Dixfield Light & Improvement Company has been chartered with a capital stock of $25,000 to generate and supply gas and electricity. R. S. Buzzell is president; E. J. Pike, treasurer, and C. L. Andrews, clerk, all of Augusta, Maine.

MONTVILLE, MAINE.—The Center Montville Telephone Company has been incorporated with a capital stock of $5,000 to operate telephone lines. The officers of the company are: J. J. Clement, president; G. L. Edwards, treasurer, and F. A. Cushman, clerk, all of Montville, Maine.

PORTLAND, MAINE.—Articles of incorporation have been filed for the Kansas Railway & Light Company by J. H. McClellan and E. Woodman, both of Portland, Maine. The company is capitalized at $1,500,000, and proposes to construct and operate railways, telephone and telegraph lines.

PORTLAND, MAINE.—The Consumers' Power Company has filed articles of incorporation with the Secretary of State with a capital stock of $20,000 for the purpose of supplying electricity. The incorporators are: A. G. McPherson, J. R. Parsons and W. N. Bradley, all of Portland, Maine.

PLAINVIEW, MINN.—The Plainview Electric Light & Power Company has been incorporated with a capital stock of $40,000 by T. G. Bolton, F. J. Cornwell, A. L. Koenig, G. F. Sylvester, of Plainview, Minn., and Arthur Koenig, of Sioux Falls, S. D.

MEXICO, MO.—The St. Louis, St. Charles & Northwestern Traction Company has been formed for the purpose of constructing an electric railway from St. Charles through Troy, Olney, Marling, Middletown, Mount Carmel, Laddonia, Mexico, Paris and points northwest. The officers are: C. B. Duncan, of Olney, Mo., president; R. E. Race, of Mexico, Mo., vice-president and manager; C. Pearson, of Middletown, secretary, and R. M. Henderson, of Middletown, Mo., treasurer.

TRENTON, N. J.—The Camden & Trenton Traction Company has been incorporated with a capital stock of $675,000 by Frensinger Evans, Eugene A. Martin and Charles R. Rent. The company proposes to operate an electric railway between Trenton and Camden. The incorporators are parties that purchased the Camden & Trenton Street Railroad Company, which was sold some time ago by a receiver.

TRENTON, N. J.—Articles of incorporation have been filed for the Elizabeth & Trenton Railroad Company, with a capital stock of $1,200,000. The company will take over the property of the Trenton & New Brunswick Railroad, which was sold May 4 under foreclosure proceedings, and also the property and franchises of the New Jersey Short Line Railroad Company, which is an extension of the main line from Milltown through New Brunswick to Elizabeth.

COSTILLA, N. M.—The San Luis Power & Water Company has been incorporated with a capital stock of $1,000,000 by Alexander Smith, George W. Bierbrauer and Michael Burley. The company proposes to operate in El Paso and Costilla counties, Colorado, and Taous County, N. M. The headquarters of the company will be located in Colorado Springs, Col.

EPHRATA, N. Y.—The Mohawk Hydro-Electric Company has filed articles of incorporation with a capital stock of $10,000 and proposes to construct dams across Peck and Garoga lakes to furnish power to generate electricity for lamps, heat and power purposes. The incorporators are: S. A. Thoresen, James B. Huff, of New York, N. Y.; Allen J. Nichols, of Brooklyn; H. M. Brinckerhoff, of Ossining, and William P. Dunlop, of Yonkers, N. Y.

COLUMBUS, OHIO—The Central Ohio Promoting Company has been incorporated with a capital stock of $25,000 for the purpose of constructing an interurban railroad between Columbus and Zanesville. The incorporators are: Albert E. Boone, D. H. King, Henry A. Axline, James L. Holden and James Grinsby.

MOORELAND, OKLA.—The Mooreland Farmers' Telephone Company has been chartered with a capital stock of $12,000 by H. P. Myers, N. B. Ames and W. H. Whitenack.

SOPER, OKLA.—The Citizens' Telephone & Telegraph Company has been incorporated with a capital stock of $20,000 by B. W. Williams, of Soper, Okla.; Edgar P. Williams, C. C. Williams, of Brundage, Ala.; W. P. Stewart and O. A. McDonald, of Hugo, Okla.

STONEWALL, OKLA.—The McKanna Power Development & Irrigation Company has been chartered by J. J. McKanna and D. McKanna, of Oklahoma City, Okla.; J. E. Smith, M. L. Wall and A. H. Constant, of Ada, Okla. The company is capitalized at $500,000 and proposes to construct a hydroelectric plant.

PORTLAND, ORE.—The Willamette Power Company has been incorporated with a capital stock of $10,000 by E. M. Croisan, W. T. Stolz and C. H. Robertson.

VIRGIL, S. D.—The Virgil Telephone Company has been incorporated with a capital stock of $10,500 by J. H. Beck, M. H. Jansen and others.

MURDOCK, TENN.—Articles of incorporation have been filed for the Murdock-Kerkhoven Telephone Company. The company is capitalized at $5,000 and the incorporators are: E. T. Dana, John Schmidt, L. H. Lawson and others.

RAYMONDVILLE, TEX.—Articles of incorporation have been filed for the Raymondville Power Company, with a capital stock of $8,000, by E. B. Raymond, S. L. Gill and W. H. Jersig.

WAUTOMA, WIS.—Articles of incorporation have been filed for the Wautoma-Mount Morris Farmers' Telephone Company, with a capital stock of $10,000. Local business men of this village and farmers of Wautoma and Mount Morris are interested in the project.

Personal.

MADAME CURIE, of Paris, has been elected a foreign member of the American Philosophical Society.

MR. JOHN W. LIEB, JR., who has recently not been in good health, has sailed for Europe for a complete rest.

MR. CHARLES F. BRUSH, of Cleveland, O., has been elected a member of the American Philosophical Society.

MR. LAMAR LYNDON has moved his office from 56 Pine Street to Knickerbocker Trust Building, 60 Broadway, New York.

MR. W. E. QUILLAN, of Montgomery, Ala., has taken charge of the "new business" department of the Easton Gas & Electric Company.

SIR OLIVER LODGE, F. R. S., principal of the University of Birmingham, will be given an honorary degree by Cambridge University.

MR. J. J. BROOKS, JR., general sales manager of the Harbison-

Walker Refractories Co., of Pittsburg, has been elected to the directorate of that company.

FORD, BACON & DAVIS, New York, have been retained by the Union Light & Power Company in connection with a valuation of its property and for other services.

MR. A. J. McMULLEN has resigned from the commercial department of the Utah Light & Railway Company, Salt Lake City, in order to enter into business in another line of work.

PROF. ELIHU THOMSON contributed an article entitled, "Some Consideration as to the Nature of Comets and Their Probable Relation to the Sun," to the issue of *Science* for May 20, 1910.

MR. C. A. TUPPER, former manager of publicity for the Allis-Chalmers Company at Milwaukee, Wis., has opened an office in San Francisco, where he will engage in engineering and contracting.

MR. CHARLES GORDON CURTIS will receive from the American Academy of Arts and Sciences the Rumford premium for his improvements in the utilization of heat as work in the steam-turbine.

MR. D. M. COUGHLIN, recently with the Easton Gas & Electric Company as manager of the "new business" department, will assume charge of the corresponding department of the Spokane Falls Gas Company.

MR. GEORGE R. DAVIS, of Ford, Bacon & Davis, recently delivered an address to the engineering classes of Tulane University, New Orleans, entitled "Business Capacity as a Factor in a Successful Engineering Career."

MR. WILLIAM R. McGOVERN, chief engineer of the Wisconsin Telephone Company, lectured before the engineering classes of Marquette University at Milwaukee, Friday afternoon, May 21, on the "Engineering and Construction of a Telephone System."

MR. W. S. DIMMOCK has resigned his position as manager of the Puget Sound Electric Railway and the Tacoma Railway & Power Company. His successor will be Mr. L. H. Bean, manager of the Whitcom County Railway & Light Company, Bellingham, Wash.

PROF. ALEXANDER S. LANGSDORF has been appointed Dean of the Engineering School of Washington University, St. Louis, Mo., succeeding Calvin S. Woodward. Professor Langsdorf will continue his work as head of the electrical engineering department, a position he has held for six years, preceding which he was assistant professor. The new dean is himself a graduate of Washington University, of the class of 1898, and received an engineering degree from Cornell in 1901. He is a member of the American Institute of Electrical Enginers, fellow of the American Association for the Advancement of Science, member of the Society for the Promotion of Engineering Education, and of the honorary society, Sigma Xi. Professor Langsdorf is also a member of the Engineers' Club of St. Louis and of the Academy of St. Louis.

MR. WILLIAM S. TWINING, chief engineer of the Philadelphia Rapid Transit Company, has tendered his resignation to take effect July 1. After that date he will be associated with Ford, Bacon & Davis, of New York, and will be engaged in special engineering work in connection with heavy electric traction and power distribution in large cities. Mr. Twining has been chief engineer of the Philadelphia Rapid Transit Company and of its predecessor, the Union Traction Company of Philadelphia, since the organization of the latter company in 1895. Mr. Twining was born Feb. 20, 1865, and was graduated from Allegheny College with the degree of C. E. in 1887. After acting as instructor in physics and engineering in that college for three years following his graduation, he entered the employ of the railway engineering department of the Thomson-Houston Company, of Philadelphia, for whom he had charge of railway construction in Indianapolis and Toledo. In the latter part of 1891 he took part in the electrical equipment of the Harlem Bridge for the Mamaroneck & Fordham Railway, now a part of the Union Railway, of New York, and in the latter part of 1892 was one of the engineers in charge of the electrical equipment of the Atlantic Avenue Railway, now part of the Brooklyn Rapid Transit Company. In the following year he was appointed assistant to the chief engineer of the Peoples' Traction Company, of Philadelphia. Mr. Twining is a member of the Cornell Club, University Club and Engineers' Club, of Philadelphia, of the American Society of Mechanical Engineers, and is an associate member of the American Institute of Electrical Engineers.

Obituary.

MR. JOHN ROONEY, president of the Rooney Electric Lamp Company, died at his residence in Brooklyn, May 18. Mr. Rooney was born in the north of Ireland seventy-one years ago, and after coming to America studied law for a time and then entered the railroad business. He was connected at various times with the St. Paul Water Works, the Southern Minnesota Railroad, the Iowa Eastern Railroad, and the Erie & Great Western, and later with the Boston, Hartford & Erie Railroad Company, of which he was president for many years. Mr. Rooney was closely associated with General Benjamin F. Butler in the settlement of the celebrated Sprague failure in Rhode Island. He was a close personal friend of President McKinley, President Benjamin Harrison, Mark Hanna and other public men. He was decorated by the Spanish Government with the Order of Carlos III, in recognition of his friendship for Spain, as shown by his work on the genealogical history of five hundred Irish families. Entering the electrical field in 1901, he became president of the American Electric Light Company, and promoted the Consolidated Electric Light Company and the Towyer Electric Company, both of which corporations subsequently were merged into the Westinghouse Electric & Manufacturing Company. He was for many years State Commissioner of the Kings Park State Hospital. Mr. Rooney is survived by a widow, three sons and three daughters.

GEN. A. B. R. SPRAGUE.—General Augustus Brown Reed Sprague, president of the Worcester, Massachusetts, Electric Light Company, died at his home, on May 17, in the eighty-fourth year of his age, after an illness of nine days. General Sprague was a native of Ware, Massachusetts, his ancestors on both sides being of Pilgrim stock. His maternal grandmother, Alice Alden, was in the fifth generation from John Alden, who came over in the Mayflower. After being educated in the public and private schools, he came to Worcester in 1842 and entered the employ of H. B. Claflin. He afterward engaged in mercantile business for himself. Joining the militia at the age of seventeen, he began a career which made him of service to his country in her hour of greatest need. He responded at President Lincoln's first call for troops in 1861, and served three years and nine months as captain of Co. A, Third Battalion of Rifles, M. V. M.; Lieutenant-Colonel of the 25th Regiment of Massachusetts Volunteers; Colonel of the 51st Regiment of Massachusetts Volunteers; Lieutenant-Colonel and Colonel of the 2d Massachusetts Heavy Artillery Volunteers, and was brevetted Brigadier-General "for gallant and meritorious services during the war." He was appointed City Marshal of Worcester in 1867, and later in that year became Collector of Internal Revenue of the Eighth Massachusetts District, remaining in that office five years. General Sprague was Sheriff of Worcester County from 1871 to 1890, having been elected for six successive terms of three years each. He served in both branches of the City Council, and in 1895 was elected Mayor of Worcester, and re-elected the following year. The new city hall was erected and many important public works were either begun or finished during his administration. He was Commander of the Department of Massachusetts, G. A. R., in 1868, and later Junior Vice Commander of the Commandery of Massachusetts of the Military Order of the Loyal Legion of the United States. He became Commander of the above order in 1908. General Sprague was one of the original stockholders of the Worcester Electric Light Company, and since 1901 has been president of the Worcester Mechanics' Savings Bank. He was at one time president of the Worcester & Holden Street Railway. He was a Mason, a member of the Worcester Society of Antiquity, and the Society of Mayflower Descendants. General Sprague's delightful personality and old-school courtesy won him a host of friends, especially among the younger generation. He carried his years lightly and filled a place of high honor in the community, in which his life was a constant example of unobtrusive service.

GENL. A. B. R. SPRAGUE.

MR. JOHN A. RYERSON, president of the Ideal Electric Company, manufacturer of electric automobiles on a small scale at 444 West Indiana Street, Chicago, committed suicide on May 16 by leaping over a railing on the thirteenth floor of the Chamber of Commerce Building in that city and plunging to the ground floor of the inner court. Mr. Ryerson was 44 years old and a native of New York City. He was graduated from Columbia University, Class of '85, and soon afterward removed to Chicago. Mr. Ryerson was a man of refinement and good connections, and it is supposed that he must have taken his life during a sudden fit of insanity.

Trade Publications.

MOTOR FANS.—Price list No. 5213 of General Electric Company, motor fans, which supersedes list No. 5173, is now ready.

FUSES.—A great variety of fuses and telephone specialties is described in Bulletin No. 300 of the American Electric Fuse Company, of Muskegon, Mich.

AUTOMATIC SIGNALS.—A trolley operated block signal for use on electric railway is described in a folder issued by the Safety Switch & Signal Company, New York.

CONTROLLERS.—A folder of the Electric Controller & Manufacturing Company, of Cleveland, Ohio, sets forth some of the good points of its mill type controller for small motors.

SUPPLIES.—The Mills Electric Company has just issued a 500-page catalog of electric supplies, machinery, telephones, etc. The printing and binding are excellent and the arrangement well adapted to facilitate rapid use. A complete index is inserted at the end of the book. The catalog is listed as No. 5.

AUTOMATIC TRACK SWITCH.—A solenoid operated track switch for street railways is the subject of a folder issued by the Safety Switch & Signal Company, New York. The mechanism of the switch is enclosed in a water-tight case, and by avoiding reciprocating motion through the stuffing-box, it is claimed that the cause of leaks has been removed.

FIRE DETECTORS.—A neat little booklet of the National Clock & Electric Manufacturing Company, of St. Louis, Mo., describes a new type of thermostat fire alarm device, which may be operated on closed or open circuits or both in combination. When operated on the combination circuit any defect in the circuit is announced by one bell, while an abnormal temperature rise causes bells to ring on both circuits.

TRANSFORMER MANUFACTURING FACILITIES.—An attractive publication recently issued by the General Electric Company is entitled "Transformer Manufacturing Facilities." The General Electric Company's facilities for the production of transformers have been increased and the Pittsfield Works are stated now to constitute one of the largest and best equipped transformer manufacturing plants in the world. This pamphlet illustrates various processes of transformer manufacture, and is sure to be of interest to all whose business is connected with electrical work. The number of this publication is 3919.

RECORDING THERMOMETERS.—The Bristol Company, Waterbury, Conn., has issued a bulletin (No. 125) describing Bristol's Class 1 self-contained recording thermometers, for recording temperatures at the point where the instrument itself is located. This type has been applied to recording temperatures in cold storage plants, as illustrated by a specimen record chart in this bulletin. Some new models of Bristol thermometers are illustrated, including a new 6-in. model of recording thermometer shown, which was patented in 1899, but this particular form is now being brought out for the first time.

HIGH VACUUM SURFACE CONDENSERS.—"High Vacuum Surface Condensers for Steam Turbines" is the title of Bulletin 106, just issued by the Wheeler Condenser & Engineering Company, of Carteret, N. J. The high steam economy obtained by steam turbines with vacuums of 28 to 29 in. is pointed out, while, on the other hand, it is shown that in obtaining these high vacuums there should be no unnecessary power consumption by the condenser auxiliaries, or excessive amounts of water used for cooling purposes. The pamphlet describes arrangements of the tube surface, the use of rain plates and other means recently devised for obtaining these results. The construction of the Wheeler dry-tube condenser is stated to be the outcome of investigations into the several factors affecting transmission of heat through condenser tubes, such as the material and cleanliness of the tubes, the velocity of water within the tube, the velocity of steam against the tube, the percentage of air in the steam surrounding the tube, and whether or not the steam side of the tube is flooded with water.

BUSINESS NOTES.

THE GARWOOD ELECTRIC COMPANY has appointed the George F. Herrig Company, of Saginaw, Mich., as its agents in Saginaw, Mich., and all territory within a radius of fifty miles of Saginaw.

THE CRESCENT SALES COMPANY of Chicago has been appointed Western agent for William A. Bonnell, 32 Church Street, New York, manufacturer of metallic flexible conduit fittings and boxes.

THE CENTURY ELECTRIC COMPANY, St. Louis, has appointed Mr. R. J. Davis as its Pacific Coast sales agent, with offices in the J. K. Armsby Building, No. 633 Howard Street, San Francisco, Cal. Mr. Davis is very well known in that territory, and will be able to care for the demands of the trade very promptly from a large stock of "Century" single-phase motors which will be carried in San Francisco.

DRY BATTERIES.—W. P. Carstarphen, of Denver, has begun the manufacture of a line of dry batteries. The new design and certain features of construction which he has adopted are claimed to produce a battery whose deterioration is much slower and mechanical strength much better than the batteries at present on the market. Two types are manufactured, one with low resistance for sparking duty, and one of higher resistance for annunciator work.

THE FUEL ENGINEERING COMPANY, of 1712 Marquette Building, Chicago, announces that it has changed its name to Krehbiel Company. The business now embraces mechanical, civil and electrical engineering, as well as fuel engineering, so that the old name fails to be descriptive. The service now offered includes reports, designing and supervision in the four branches of engineering mentioned. Edwin H. Cheney is president of the company, and Fred A. Krehbiel treasurer.

NEW SALES OFFICES OF ELECTRIC STORAGE BATTERY COMPANY.—The Electric Storage Battery Company has opened two new sales offices, one located at No. 729 Ford Building, Detroit, Mich., and another at 1424 Wazee Street, Denver, Colo. A stock of battery material will be carried, from which orders can be promptly filled. The addition of these offices as well as the St. Louis "Exide" storeroom, recently opened at Sixteenth and Pine Streets, very materially increases the facilities of this company in the West.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 17, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

957,866. COIL FOR DYNAMO-ELECTRIC MACHINES; G. Chovan, Pittsburgh, Pa. App. filed March 3, 1906. A coil consisting of a plurality of turns of strap conductor, one of which projects beyond the other at one end to form a loop which is twisted and riveted together.

957,869. INTERCOMMUNICATING TELEPHONE SYSTEM; E. R. Corwin, Chicago, Ill. App. filed Sept. 23, 1907. Intercommunicating system for automatic exchange, with a common trunk line, a relay, a key for bridging the relay across the trunk and a switch controlled by the relay for maintaining the bridge.

957,870. RELAY; A. S. Cubitt, Schenectady, N. Y. App. filed June 24, 1908. Solenoid operated relays for dynamos.

957,876. COIL FOR DYNAMO-ELECTRIC MACHINES; J. D. Forrer, Pittsburgh, Pa. App. filed July 24, 1908. A plurality of multi-strands, one above the other, the strands located side by side and reversed once in each closed turn of the coil.

957,877. ARMATURE WINDING COIL FOR DYNAMO-ELECTRIC MACHINES; J. D. Forrer, Pittsburgh, Pa. App. filed Sept. 8, 1908. Multi-strands having two parallel straight portions, parts of them being located in one plane and parts in the perpendicular plane.

957,882. COIL FOR DYNAMO-ELECTRIC MACHINES; W. T. Hensley, Wilkinsburg, Pa. App. filed Jan. 10, 1908. Avoids the radial portions of the leads being crowded between adjacent coils by constructing the strands with an off-set bend located one above the other.

957,891. ELECTRIC PLUG; R. R. Lang, Iola, Kan. App. filed Jan. 25, 1909. Consists of two members swiveled together with an axial stem of insulating material.

957,909. AUTOPHONE SYSTEM; A. E. Stevens, Fall River, Mass. App. filed Nov. 6, 1908. Automatic telephone exchange with a calling line, a called line, means whereby the latter may call a third line and whereby the connection to the calling line is severed until that to the third line is completed, whereupon the connection is re-established to the calling line.

957,911. RAIL-BOND; C. R. Sturdevant, Worcester, Mass. App. filed Aug. 23, 1906. A rail having a bottom hole therein with an annular groove in the wall for receiving a terminal stud, the bottom of the hole forming an anvil surface for the end of the stud.

957,945. STARTING SWITCH FOR ELECTRIC MOTORS; E. Garside, Darlington, England. App. filed Oct. 2, 1909. For cutting out a series of resistances by a particular form of pivoted switch with dash pot, cross head, spring and toggles.

957,951. GAS IGNITER; C. L. Haase, Jr., Milwaukee, Wis. App. filed May 29, 1909. For lighting gas burners by means of a jump spark from an induction coil and a wrench for controlling the gas valve and simultaneously closing the primary circuit of the coil.

957,953. ELECTRICAL SWITCH; J. O. Heinze, Jr., Lowell, Mass. App. filed March 3, 1909. On-and-off switch or foot switch for automobiles, making use of a key which is concealed and can be removed for disconnecting the circuits.

957,968. CALL BOX SIGNALING SYSTEM AND APPARATUS THEREFOR; C. C. Johnson, Yonkers, N. Y. App. filed Oct. 5, 1907. Improvement on prior patents by improving a separate alarm transmitting mechanism, which sends its signals only when the box is operated for sending the alarm.

957,973. SIGNALING SYSTEM; O. T. Lademan, Milwaukee, Wis. App. filed March 27, 1909. Metallic line telephone circuit, including a plurality of relays which are non-inductive with respect to the metallic circuit and which can be operated over the two metallic conductors in parallel as a telegraph system.

957,977. PROTECTIVE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed Sept. 9, 1905. A clip for fuse holders with a pair of side springs having terminal fingers crossed and intermeshed, which are maintained crossed against the outward tension of the side springs with a notch which can be brought into relation with ears so as to permit the separation of the fingers.

957,983. ELECTRIC TUBE LAMP AND SIMILAR DEVICE; D. McF. Moore, Newark, N. J. App. filed May 6, 1902. A positive electrode formed with a multiplicity of discharge points and a cathode composed of a highly refractory oxide forming the walls of a constricted passage.

958,046. INSULATING COVERING FOR CABLES; P. Torchio, New York, N. Y. App. filed May 4, 1909. Spirally winds insulating strips around a cable and saturates them with a rubber solution.

958,047. TRAIN-STOPPING MECHANISM; J. F. Webb, Jr., New York, N. Y. App. filed Dec. 12, 1908. A valve with a rotary stem which actuates another valve with electrical means for restoring them to normal position, so as to set the brakes and then release them.

958,067. TELEPHONE SYSTEM AND APPARATUS; A. K. Andriano, San Francisco, Cal. App. filed July 3, 1909. Interconnecting telephone system doing away with the operator at the central station, with movable contact locking devices therefor, telephone support locking the movable contact when it is hung up and unlocking when removed, a ringing key, supplementary locking device thrown in when the ringing key is pressed and thrown out when the telephone is returned.

958,111. CURRENT REDUCER; B. L. Hadfield and H. A. Hall, Wausau, Wis. App. filed May 25, 1909. A dimmer for theaters. Details.

958,145. TELEPHONE METER SYSTEM AND APPARATUS; R. H. Manson, Elyria, Ohio. App. filed April 18, 1907. A time registering device, an electric motor therefor, speech transmitter and receiver and circuit connections completed when the instruments are used to operate the motor.

958,167. TRANSMITTER MOUNTING; N. Pedersen, Genoa, Ill. App. filed June 4, 1909. Two members through which a shaft passes permit an oscillatory motion of the mounting plate with relation to the head.

958,180. METHOD OF PRODUCING TANTALUM; Johannes Schilling, Halensee, near Berlin, Germany. App. filed Oct. 15, 1906. Converts an oxygen compound of tantalum into hydrogenous tantalum and keeps the product molten and draws off hydrogen.

958,181. RECEIVER FOR WIRELESS TELEGRAPHY; W. Schloemilch, Berlin, Germany. App. filed Aug. 31, 1906. A detector is combined with a thread galvanometer acting as an indicator.

958,195. CONTROLLING DEVICE FOR VAPOR APPARATUS; P. H. Thomas, Montclair, N. J. App. filed July 16, 1907. A supplementary positive electrode in the light path nearer to the main negative electrode than the positive, and a high resistance filament between the supplemental and main positive electrodes.

958,209. PORTABLE STATION FOR WIRELESS TELEGRAPHY; Georg Von Arco, Berlin, Germany. App. filed Oct. 31, 1907. A metal mast made of sections with an umbrella-shaped aerial.

958,216. ELECTRIC LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed April 11, 1907. A base of insulating material with lamp receiving means on one side and means for securing a base to a support on the opposite side. Details.

958,217. EXTENSION SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July 23, 1909. A plug, a threaded contact therefor, and a tangentially arranged resilient strip for engagement with the interior of the socket.

958,224. ELECTRIC SIGNALING APPARATUS; L. W. Carroll, Anamosa, Ia. App. filed July 16, 1906. A selective telephone signaling system, including tuned reed and an electric variable resistance device operated from the reed.

958,248. TELEPHONE SYSTEM; L. E. Hicks, Stinson, W. Va. App. filed July 30, 1908. For party telephone lines in which the subscriber's instrument includes a mechanically rotatable toothed member carrying an electrical contact, a hand or pointer fastened thereto, another toothed member provided with an electric contact engaging the first contact, and an electrical motor for actuating the second toothed member step by step.

958,315. TELEPHONE SYSTEM; E. C. Rodman, West Point, Ia. App. filed Dec. 28, 1908. Central energy system with the line normally connected to the central battery and the cord circuit normally disconnected therefrom, the connection of the cord with two lines breaking one leg of each line and establishing two routes, one local to the exchange and the other including both of the connected stations, the routes being bridged by the common battery at one point and an inductive resistance clearing out signal at the other.

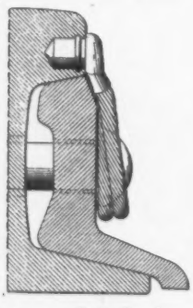
958,320. ELECTRICAL MEASURING INSTRUMENT; F. W. Roller, East Orange, N. J. App. filed Sept. 13, 1906. For testing bonds in railway systems by means of a contact bar, a plurality of saw blade contacts and clamping bars for holding the contacts in position.

958,354. ELECTRIC MOTOR; C. E. Avery, Jersey City, N. J. App. filed April 8, 1909. Toy motor with crank shaft, bed plate, flywheel and electromagnet.

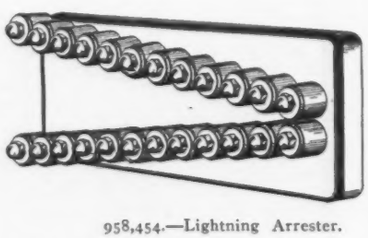
958,365. MOTOR CONTROLLING DEVICE; L. S. Chapman, Schenectady, N. Y. App. filed May 22, 1908. A starting rheostat with biased controlling arm and latch for holding it in running position, and a double throw switch.

958,380. MOTOR CONTROLLING DEVICE; George T. Eagar, Ballston Spa, N. Y. App. filed Feb. 3, 1910. A circuit controller for motors, including a plurality of manually operated switches for controlling an electromagnet switch.

958,391. VAPOR RECTIFIER SYSTEM; C. M. Green, Lynn, Mass. App. filed Aug. 11, 1905. A single-phase source of alternating current, a consumption circuit, a vapor rectifier therefor, a second rectifier in



957,911.—Rail Bond.



958,454.—Lightning Arrester.

series with the consumption circuit and automatic means for maintaining a constant current in the latter.

958,405. COMMUTATOR; H. T. Johnson, New York, N. Y. App. filed May 13, 1909. Connectors of metal sheets between commutator strips and having lugs for attachment to the armature coils.

958,442. MOTOR CONTROL APPARATUS; A. E. Stevens, Madison, Wis. App. filed May 19, 1905. For heavy machinery in which the motor serves as a braking generator and the controlling member cuts the resistance out of the motor circuit when the switch is in the starting position, and returns to full resistance position as the switch is moved from the starting to the stopping position.

958,445. STARTING DEVICE FOR VAPOR APPARATUS; P. H. Thomas, East Orange, N. J. App. filed May 9, 1904. Utilizes the rise of potential resulting from the tendency of an unstable current (such as a diminution of its flow through a shunt circuit) to drop out so as to overcome the resistance of the vapor columns.

958,453. SWITCHING KEY; L. A. Williams, Evanston, Ill. App. filed July 23, 1909. Operator's key for party line ringing current, each key having a plurality of buttons with a normal, an indicating and a ringing position, together with a ringing cam and switch springs.

958,454. LIGHTNING ARRESTER; H. C. Wirt, Schenectady, N. Y. App. filed Dec. 22, 1905. An insulating base supporting a plurality of conducting cylinders in two converging rows.

958,457. RHEOSTAT; W. C. Yates, Schenectady, N. Y. App. filed July 18, 1907. A starting rheostat including a resistance varying switch and an electromagnet switch in parallel circuit therewith.

958,458. ELECTRIC COOK STOVE; F. H. Zeigen, Detroit, Mich. App. filed March 18, 1909. Analagous to a fireless cooker with heat insulating walls and heating units disposed within the chamber.

958,488. X-RAY TUBE; Henry Green, Hartford, Conn. App. filed Nov. 23, 1909. Has an artificially formed cellular portion in the path of the X-rays, so as to determine when the tube is cured.

958,508. SHUNT FOR ELECTRIC METERS; R. C. Lanphier, Springfield, Ill. App. filed Sept. 4, 1909. Has a bridging connection

958,488.—X-Ray Tube.

between its end terminals and a variable resistance member adapted for connection to an instrument, with means for connecting said member to the bridging connection.

958,509. VIBRATOR FOR INDUCTION COILS; B. L. Lawton, Meriden, Conn. App. filed Nov. 25, 1908. Details in the means for adjusting the vibrator.

958,554. PULL SOCKET; F. E. Slady, Bridgeport, Conn. App. filed April 24, 1909. A chain rail with means for securing the chain thereto and for limiting the length of the chain within the socket.

958,560. TELEPHONE REPEATER; P. Stragiotti, Hurley, Wis. App. filed Aug. 11, 1908. The coils of the repeater are inserted in one side of the electrical triangle and two identical secondary coils are inserted in the other sides.

958,561. TELEPHONIC TRANSMITTER; P. Stragiotti, Hurley, Wis. App. filed Aug. 11, 1908. Differential transmitter with an auto induction coil applied to a differential microphone.

958,564. LEVER CHECK FOR ELECTRIC CONTROLLERS; J. Thomas, New York, N. Y. App. filed Aug. 14, 1909. A controller spindle carrying a segment and co-operating with an arm carrying a pawl which is obstructed when the arm is moved outwardly.

958,574. ELECTRICALLY CONTROLLED GAS IGNITING AND EXTINGUISHING DEVICE; E. S. Allen, New Haven, Conn. App. filed Oct. 23, 1907. The magnet is located within the gas tube on which the gas tip is mounted, the gas tube being made in sections.

958,598. ELECTRIC SWITCH; F. L. Collins and E. A. Hultz, Chicago, Ill. App. filed June 3, 1909. A shell adapted to contain oil, a horizontal insulating slab supported in the oil with fixed contact terminals on the under face of the slab and a contact member pivoted beneath the slab.

958,625. ELECTRIC LAMP SOCKET CAP; G. W. Goodridge, Bridgeport, Conn. App. filed Oct. 20, 1908. A flange with perforations and corrugations and a smooth enclosing ring arranged over them.

958,626. ELECTRIC LAMP SOCKET CAP; G. W. Goodridge, Bridgeport, Conn. App. filed Oct. 22, 1909. A flange with a ring to secure the shell to the cap, said ring being secured within the flange of the cap.

958,627. TELEPHONE SYSTEM; C. L. Goodrum, Atlantic City, N. J. App. filed March 15, 1902. Complete metallic circuit and central energy type in which the line and supervisory signals are controlled by jacks each having a test ring normally connected solely with the line and a cord circuit with three way plugs provided with sleeve contacts registering with the testing rings, the tip and sleeve contacts of each jack being connected to the line signal side of its allotted line.

958,652. METHOD OF REGENERATING CARBON FILAMENT ELECTRIC INCANDESCENT LAMPS; E. A. Kruger, Seehausen, Altmark, Germany. App. filed April 1, 1909. Opens the lamps, burns off the carbon, makes a vacuum, then introduces pure hydrocarbon, flashes, evacuates and seals.

958,681. TURBO-UNIPOLAR GENERATOR; O. Schulz, Schlachtensee, near Berlin, Germany. App. filed Feb. 4, 1909. A plurality of armatures revolve in opposite directions and elastic roller cylinders of conducting material are arranged between them.

13,115. REGENERATIVE SYSTEM OF CONTROL; W. Cooper, Pittsburgh, Pa. App. filed March 2, 1910. For electric railway motors for converting the generators into braking motors, particularly for alternating-current motors of the commutator type, one machine serving as an exciter with its armature connected to the field magnet winding of the remaining machine, the latter being connected to a transformer winding, the points of connection being so adjusted that the current supplied to the transformer is substantially constant.